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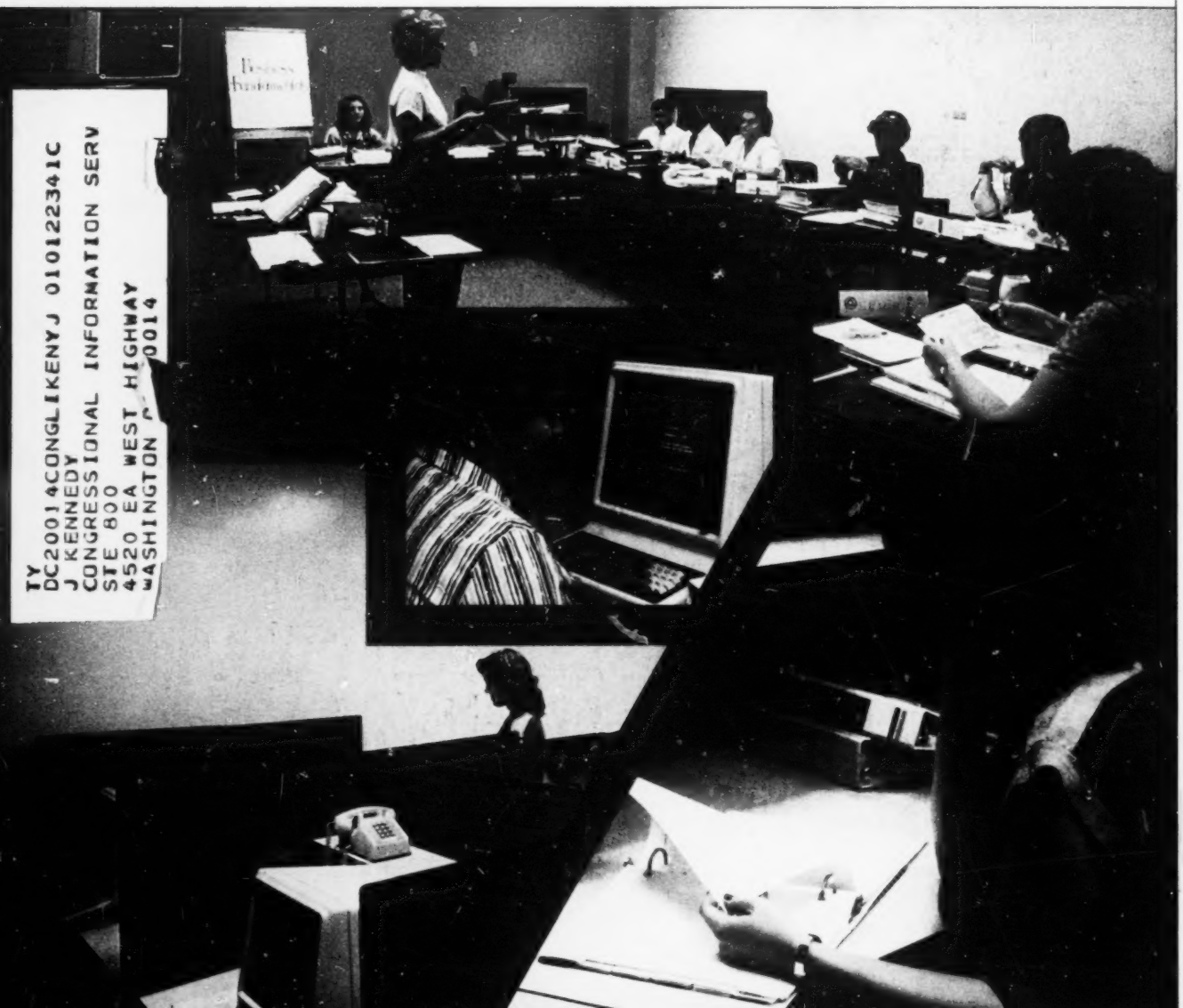

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Telecom's big spenders

Two surveys conducted this year indicate that ICA and ACUTA, industrial and educational groups, spend a significant proportion of their budgets on telecommunications

NORMAN H. SEFTON

SURVEYS CONDUCTED in 1981 by two nationally respected communication user groups reveal some interesting facts relating to the magnitude of their expenditures on telecommunication services.

NORMAN H. SEFTON is Assistant Business Manager-Communications for Duke University, Durham, N.C., and Region II Director for the Assn. of College and University Telecommunications Administrators. This article was adapted from one that appeared in the ACUTA News, July 1981, Vol. 10, No. 7.

The International Communications Assn. (ICA) survey collected data from 227 member companies, which represented 51% of the total membership. The projections from the base data showed the ICA member companies spent $8.77 billion dollars per year on telecommunications services. By the same token, the Assn. of College and University Telecommunications Administrators (ACUTA) had a response from 66 member institutions, which represented 40% of the total membership. Projecting ACUTA's expense to the entire membership shows that they spend $266.8 million per year on telecommunications.

The two surveys were identical in their methodology, except that ICA asked for data relating to sales and total corporate expenses and the ACUTA survey only dealt with total university expenses

MAP INDICATES the five ACUTA regions.

Table 1
ICA SURVEY

Rank	Type of Industry	% Sales
1	Computer Services	4.40%
2	Instruments	1.40%
3	Electrical/Electronics	1.30%
3	Office Equipment/Computer	1.30%
4	Airlines	1.20%
5	Retail-Non Food	1.00%
6	Financial-Non Bank	.98%
7	Transportation-Shipping and Rail	.86%
8	Trucking	.75%
9	Aerospace	.61%
10	Conglomerates	.58%
11	Utilities	.53%
12	Tire/Rubber	.43%
13	Insurance	.42%
14	Building Material	.40%
15	Oil Service and Supply	.39%
16	Machinery	.37%
17	Manufacturing	.36%
18	Paper	.35%
19	Chemicals	.34%
20	Textiles and Apparel	.30%
21	Automotive	.29%
22	Steel/Metal/Mining	.27%
23	Food Processing	.25%
24	Energy	.18%
25	Retailing-Food	.14%

Table 2
ICA SURVEY

Rank	Type of Industry	% Expense
1	Computer Services	6.20%
2	Retail-Non Food	3.00%
3	Instruments	2.50%
4	Banks and Bank Holding Companies	2.10%
5	Oil Service and Supply	1.80%
6	Electrical/Electronic	1.70%
7	Office Equipment/Computer	1.60%
8	Airlines	1.20%
8	Financial-Non Bank	1.20%
8	Universities	1.20%*
9	Transportation-Shipping and Rail	.96%
10	Drugs	.83%
11	Trucking	.80%
11	Utilities	.80%
12	Tire/Rubber	.74%
13	Insurance	.73%
14	Conglomerates	.66%
15	Aerospace	.64%
15	Government	.64%
16	Manufacturing	.60%
17	Steel/Metal/Mining	.52%
18	Machinery	.51%
19	Building Material	.48%
20	Paper	.44%
21	Food Processing	.42%
22	Chemicals	.40%
23	Textiles and Apparel	.35%
24	Automotive	.30%
25	Energy	.24%
26	Retailing-Food	.20%
	Overall Average of Sample	.65%

*ACUTA Survey of 66 Universities Averaged 1.1%

(universities do not keep records on sales).

Tables 1 and 2 show the relative ranking by industry in each of the two categories (sales and expense). It was interesting to note that computer services type industries were ranked first in both sales and expenses. Their ratio was 4.4% of their gross sales and 6.2% on their total corporate expenses.

On the other end of the scale, we find retailing—food having a ratio of 0.14% on sales and 0.20% of expenses on telecommunications. The ICA survey showed an average for all types of industries to be 0.51% on sales and 0.65% on expenses.

Both surveys showed that universities ranked very high (no. 8. or 1.1% to 1.2%) in percent to expenses. Universities were tied with such giants as airlines and financial non-banking institutions. In many instances, universities have not been regarded as big users of telecommunications; however, this survey shows that as a percent of total university expense they rank in the top 10. The ACUTA survey (see Table 3) also showed that schools with major hospitals spent more than those without hospitals and that private schools with hospitals spent more than state or public universities with hospitals. However, public universities which did not have hospitals spent more than private universities without hospitals.

'It was interesting to note that computer services type industries were ranked first in both sales and expenses.'

The ACUTA survey also collected data by regions of the country. This regional data showed that schools in Region IV (the Midwest) spend slightly more as a percentage of expenses than other schools; however, this may not be conclusive due to the small sample of schools reporting in Region IV.

The major conclusion is that in both industry and education, ICA and ACUTA represent a marketplace of over $9 billion annually and a significant amount of the groups' total budgets are used for telecommunications. □

Table 3
ACUTA
Expense Survey Results
1980

Region*	Number of Responses	Telecom Expenses	Total University Expense	Expense % Ratio
		(All Reporting Universities)		
I	17	$ 23,940,786	$ 1,970,580,492	1.2%
II	11	17,297,153	1,302,504,353	1.3%
III	29	46,146,938	4,660,560,632	.9%
IV	5	10,581,668	625,062,747	1.7%
V	4	8,487,432	813,585,922	1.0%
Total	66	$ 106,453,977	$ 9,372,294,146	1.1%
		(Public With Hospital)		
I	1	$ 1,900,000	$ 126,000,000	1.5%
II	2	3,980,394	409,531,871	1.0%
III	7	22,024,902	2,134,208,846	1.0%
IV	2	6,250,000	283,853,241	2.2%
V	1	3,042,969	297,219,000	1.0%
Total	13	$ 37,198,265	$ 3,250,812,958	1.2%
		(Public Without Hospital)		
I	4	$ 4,161,263	$ 226,695,981	1.8%
II	7	7,092,569	590,433,284	1.2%
III	18	19,438,544	2,101,463,038	.9%
IV	3	4,331,668	341,209,506	1.3%
V	3	5,444,463	516,366,922	1.1%
Total	35	$ 40,468,507	$ 3,776,168,731	1.1%
		(Private With Hospital)		
I	5	$ 9,981,458	$ 830,441,200	1.2%
II	2	6,224,190	302,539,198	2.1%
III	1	3,200,000	275,000,000	1.2%
IV	None Reported in Survey			
V	None Reported in Survey			
Total	8	$ 19,405,648	$ 1,407,980,398	1.4%
		(Private Without Hospital)		
I	7	$ 7,898,065	$ 787,443,311	1.0%
II	None Reported in Survey			
III	3	1,483,492	149,888,748	.1%
IV	None Reported in Survey			
V	None Reported in Survey			
Total	10	$ 9,381,557	$ 937,332,059	1.0%

*See Map for Location

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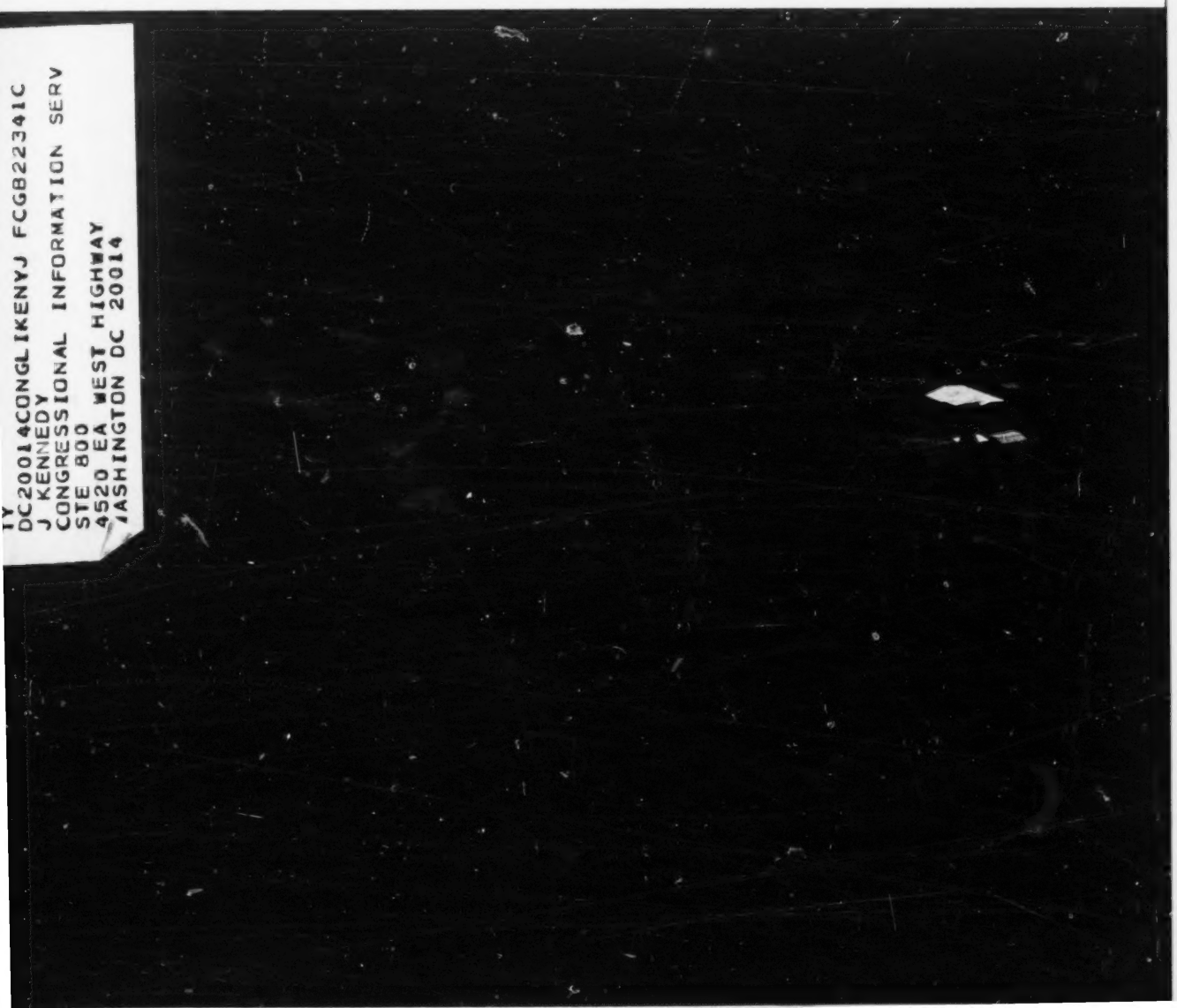

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Power for remote telecom sites may be blowin' in the wind

In some remote areas not served by public electric utilities, wind power is a promising energy source. Here's one way to harness its potential

DONALD J. MAYER

THE USE OF THE POWER in the wind as an energy source is hardly a new technological breakthrough.

As early as 2800 B.C., the Egyptians used sails to assist the rowing power of slaves. The Persians used vertical axis windmills to grind grain in the seventh century A.D.

The Crusades brought that technology to Europe. The Dutch developed the horizontal axis propeller-type windmill that Don Quixote battled in his dreams. It was an American innovation in the early 19th century that resulted in the common American water-pumping windmill or prairie fan. At the turn of the century, electricity was produced by windmills in America and Denmark. By 1930 more than 12 manufacturers in the United States alone were producing "windchargers" (now called small wind energy conversion systems or SWECS) for farmers in the Plains States. For many American farmers, the first experience with electricity was from a windcharger used to charge batteries to power a radio.

These small wind machines were sold by retailers as a package consisting of a radio, battery and roof mounted windcharger. This marks the start of the use of wind energy as a power source for telecommunications applications.

The vibrant wind industry of the 1930s and '40s saw the development of larger wind electric systems culminating in the 1250 kilowatt (kw) giant Smith-Putnam machine on Grandpa's Knob near Rutland, Vt., which produced electricity for Vermont during World War II. However, also during this time the Rural Electrification Act was passed, bringing government subsidized power to remote farms and homesteads, and forcing the wind industry into a period of hibernation.

DONALD J. MAYER is Vice President of North Wind Power Co., Inc., Waitsfield, Vt.

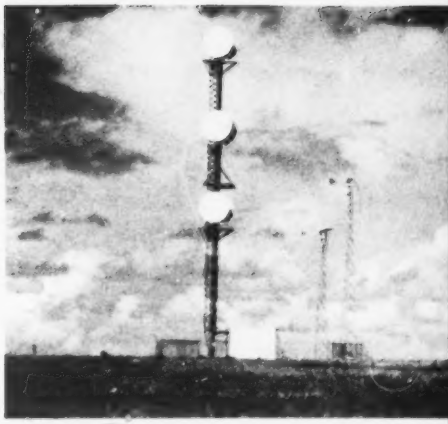


PHOTO shows two HR2 systems at the MCI microwave site in Kenna, N.M.

The competition from cheap government subsidized electrical power forced many manufacturers out of business and others moved into other areas. Some wind system manufacturers, however, began to seek new markets for their products. They found them in the remote power market for cathodic protection of pipelines, navigational aides and remote communications installations. These new cost-effective applications were not enough, however, to support the industry, and during the 1950 to 1970 period most manufacturers folded. The reawakening of energy consciousness sparked by the oil embargo of 1973 and the rapid escalation of fuel costs has sparked new interest in wind energy and a rebirth of the wind industry.

Finding a dependable source of electric power for remote microwave relay stations is a familiar and difficult problem for the communications engineer. Due to the nature of ultra-short electromagnetic waves, relay stations must be situated in mutual optical view and must be at a maximum vertical elevation. The best sites for microwave links almost necessarily have the disadvantage of limited accessibility and, in many cases, the cost of extending commercial power to such sites is prohibitive. The transportation and storage of fuel becomes a major factor in the cost of supplying independent power to such stations.

The rapid expansion of the worldwide telecommunications network and escalating fuel and transportation costs have caused communication planners to look at wind energy as an answer to the power problem.

The major deterrent to widespread

Table 1

Performance and environmental design criteria

Reliability:	The mean time between failures for the system shall be not less than 10 years.
Maintainability:	One maintenance day per year maximum.
Durability and life:	Machine shall operate continuously in extreme conditions and have a 25-year life.
Cut-in windspeed:	Minimize with regard to power production and system cost.
Cut-out windspeed:	Maximize with regard to power production and system cost.
Survival windspeed:	54 miles per second (120 miles per hour) minimum for steady winds; gusting to 75 miles per second (165 miles per hour)
Temperature:	−60°c to +60°c; (−76°F to +140°F).
Rain:	Torrential downpour accompanied by winds.
Snow, sleet, ice:	Ice buildup to 60 millimeters (2.5 in.) on all surfaces.
Hail:	Impact by hail up to 40 millimeters (1.5 in.) diameter.
Salt water spray:	Heavy ocean spray.
Dust:	Fine sand and dust accompanied by winds gusting to 45 miles per second (100 miles per hour).

usage of wind has been that little hardware was available; much of what was available was prone to failure and not designed to operate unattended in difficult environments.

This need for reliable wind systems for remote power was recognized by the U.S. Dept. of Energy (DOE). In 1977 DOE issued a request for proposals to develop a high reliability SWECS capable of supplying power in remote sites and harsh environments. Table 1 indicates the DOE design criteria for this wind machine.

North Wind Power Company, Inc., Waitsfield, Vt., responded to the DOE request and received a 2 year contract to design, develop and test a high reliability wind machine for remote applications.

The company's approach was to achieve reliability by limiting the number of moving parts and by using sophisticated aerodynamic and structural analysis to design a SWECS capable of meeting the government's stringent reliability criteria. The result of that effort was the HR2 wind electric system (Figure 1).

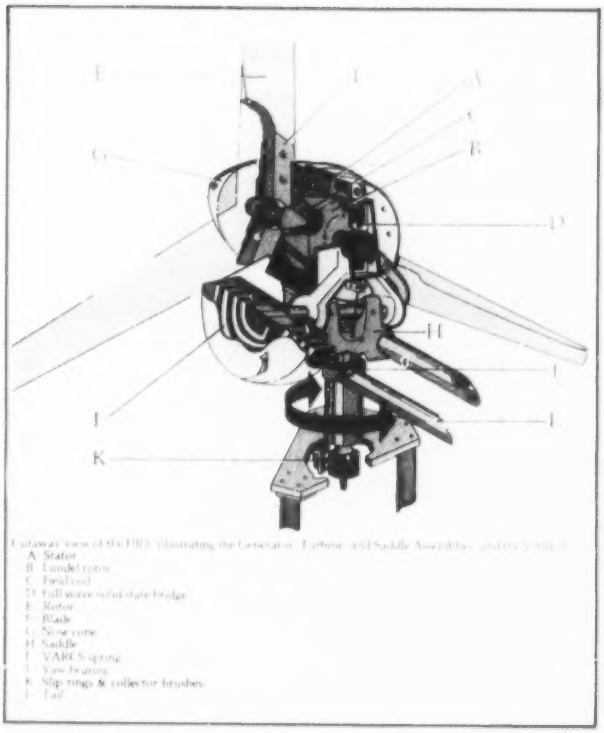
The system was a three bladed rotor directly connected to a specifically designed slow speed alternator. A unique mechanism called the VARCS (Variable Axis Rotor Control System) permits the rotor/generator to tilt back in winds over 20 miles per hour (mph). The VARCS combines in itself the critical functions of overspeed control, high wind shutdown and reset and manual shutdown for maintenance (Figure 2).

Since its introduction in 1979, the wind system has been used in remote applications ranging from cathodic protection of a buried pipeline on the Gulf of Mexico for Harco Corp., Houston, Texas, and the Houston (Texas) Natural Gas Pipeline Co., to powering remote telecommunications and telemetry in the Canadian Rockies. The system also is undergoing long-term testing by DOE in Colorado, by the U.S. Army in Arizona, by the Canadian Coast Guard in New Brunswick and in the Mexican national telephone system.

Of special interest to the telecommunications industry is the system's favorable economics for remote sites, particularly mountain top repeater sites which generally have adequate wind resources.

In typical installation at a remote repeater site, the wind system is mounted on an appropriately sized mast (20 ft. above any obstructions within 500 ft.) and is used to charge batteries to power the radio equipment. A voltage regulator protects the battery from overcharge and an auxiliary engine, thermo-

FIG. 1 *Cutaway view of the HR2, a wind power system.*



electric or turbine generator can be installed to provide power for extended windless periods and to provide redundancy for increased reliability. A recent project with MCI Communications Corp., Washington, D.C., in Kenna, N.M., was a special application, retrofit-

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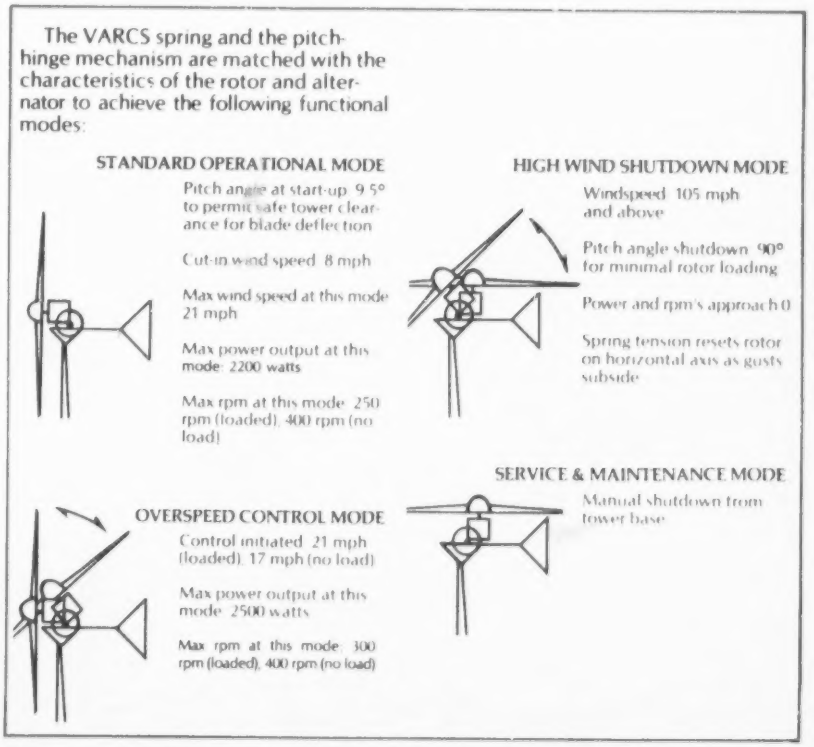
The VARCS spring and the pitch-hinge mechanism are matched with the characteristics of the rotor and alternator to achieve the following functional modes:
STANDARD OPERATIONAL MODE
Pitch angle at start-up 9.5° to permit safe tower clearance for blade deflection
Cut-in wind speed 8 mph
Max wind speed at this mode 21 mph
Max power output at this mode 2200 watts
Max rpm at this mode 250 rpm (loaded), 400 rpm (no load)
HIGH WIND SHUTDOWN MODE
Windspeed 105 mph and above
Pitch angle shutdown 90° for minimal rotor loading
Power and rpm's approach 0
Spring tension resets rotor on horizontal axis as gusts subside
SERVICE & MAINTENANCE MODE
Manual shutdown from tower base
OVERSPEED CONTROL MODE
Control initiated 21 mph (loaded), 17 mph (no load)
Max power output at this mode 2500 watts
Max rpm at this mode 300 rpm (loaded), 400 rpm (no load)

FIG. 2 *The functional modes which can be achieved by the VARCS spring and pitch-hinge mechanism.*

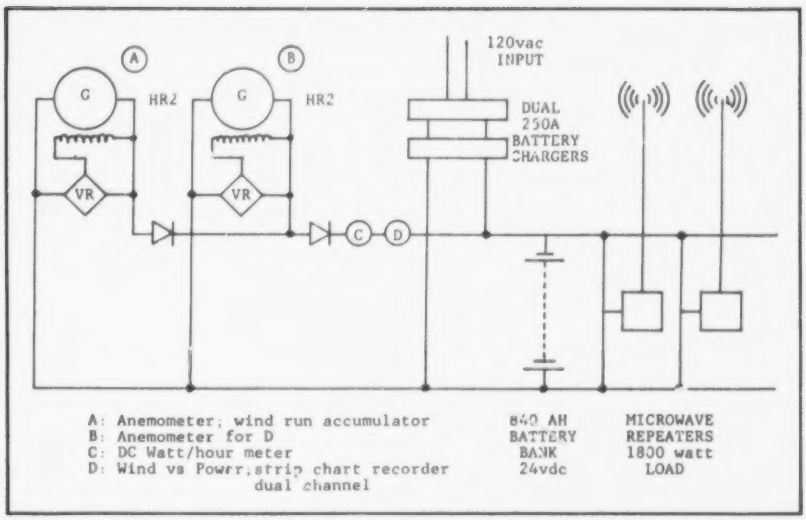

FIG. 3 *Schematic diagram of the hybrid power system at the MCI microwave repeater site in Kenna, N.M.*

ting the HR2 system at an ordinary microwave repeater site. MCI has many repeater sites, most of which are powered by the commercial utility grid. The Kenna site is a link in the Dallas, Texas, to Los Angeles, Calif., system and the continuous load at the site is typical—1.8 kw at 24 vdc (volts, direct current) nominal. This site is connected to the utility grid system and employs two 6 kw battery chargers to support the load and maintain an 840 amp per hour capacity battery bank. Two wind power systems were added to provide back-up power to extend the off-grid operating capability of the site without installing additional battery capacity or a diesel and related support equipment. Western Texas and eastern New Mexico are subject to severe winter ice storms; consequently, utility outages may exceed 48 hours. This area also has a significant wind resource with annual averages of 12 to 15 mph.

Initial power calculations indicated that the wind power system would permit the site to operate indefinitely without utility back-up from October through May. In the worst case summer months, the system can provide an average additional 5 days of operation when utility power is unavailable. Due to leasehold constraints, both units had to be placed within a 60 ft. square which includes the microwave tower and the shelter. With this constraint, good wind turbine siting practice dictated that the centers of the rotors be placed at different heights from each other and from the dishes themselves. A site plan was developed which placed one unit in the southwest corner on a 40 ft. Rohn self supporting tower, manufactured by Unarco-Rohn, Peoria, Ill. The first microwave dish is at 50 ft. The second unit was placed in the southeast corner on a 60 ft. self supporting tower. This layout places the 40 ft. tower upwind of the 60 ft. unit in the prevailing southwesterly winds and both machines upwind of the microwave tower.

The data taken thus far at Kenna have confirmed many of the performance parameters of the individual units and the total system. The power system uses the logic of the voltage regulators in the bat-

Continued on page 30

Table 2

Energy cost comparison of remote power systems (400 watt continuous load)

	Wind	Thermo-electricity	Gas turbine	Solar	Diesel
Capital costs					
General equipment	9800	15,920	18,854	55,000	5560
Site equipment fuel tanks, installation, tower or battery housing	10,000	10,000	10,000	10,000	10,000
Battery storage	6000	1500	1500	6000	1500
Installed cost	25,800	27,420	30,354	71,000	17,060
Operating costs					
Annual maintenance	500	750	1000	500	2000
Fuel (at about $2.00/gallon)	00	8760	5464	00	4029
10 year annual operating and maintenance	5000	95,100	64,640	5000	60,290
10 year life cycle cost	30,800	122,520	94,994	76,000	77,350
10 year kilowatt hour production	35,040	35,040	35,040	35,040	35,040
Cost per kilowatt hour	0.88	3.50	2.71	2.16	2.20

tery chargers and in the wind systems to shift the load from one power source to another (Figure 3). The battery chargers are set-up in parallel for float service at 2.2 vpc (volts per call) for a dc bus voltage of 26.5 vdc. The HR2 regulator is set at 27 vdc to limit the battery state of charge to 2.25 vpc. This arrangement limits the voltage window of the wind power system to 0.5 volts (26.5 vdc to 27 vdc). While this severely limits the total useful energy output of the wind system, it does permit some energy capture in normal operation while preserving the life of the float service batteries which were already in place at Kenna. In a new power system, deep discharge batteries would be specified for a wider voltage window and greater energy capture.

In a low wind condition, the battery chargers are on and supporting the load while maintaining the battery bank on float service at 26.5 vdc. As the wind speed increases, the terminal voltages of wind units reach that voltage and exceed it. At this point, in a 19 mph wind, the battery chargers cut-out and the wind units pick-up the load and begin to charge the batteries. When the bus voltage reaches 27, the regulator tapers back the generator field current to maintain that voltage. The load is now supported and the batteries are floated at this higher voltage by the wind power system. As the wind dies, the output voltage sags and the battery chargers cut-in again.

Given adequate wind resource, wind generated electrical power is the most cost effective means of providing power to remote non-utility connected sites with loads ranging from 200 to 1200 watts. The cost of energy for a remote power system is a function of the installed cost, the annual operating and maintenance costs, and the load. For SWECS, the wind resource at the site determines the maximum annual energy available and, as such, the size of the unit or number of units and the battery storage needed to meet the load requirements.

For cost comparison of power sources, a 400-watt load was selected as representative of a telecommunications site (Table 2). The site was assumed to be reasonably remote; that is, too far from utility power for economical hook-up. Installation costs include materials, delivery, concrete pads, labor and the items specifically required for one power source but not others; such as, fuel storage facilities and related site development costs or the cost of the large support structure required for solar cell arrays.

From Table 2, the cost per kwh (kilowatt hour) indicates significantly reduced energy costs: $0.88 per kwh for the HR2 against $2.20 per kwh for diesel and $2.16 per kwh for solar cells. The cost savings alone appear to justify application of a SWECS-based power system to reduce fuel consumption or reduce solar cell array and battery size. A wind power system at a television repeater site in Montana, for example, has displaced TEG (thermoelectric generator) supplied power for the last 18 months, saving more than $4500 in fuel costs alone ($1.00 per gallon).

Wind power today, within the remote power market, is at the threshold of acceptance. The perception of SWECS as a new, untested energy resource will change rapidly as more successful systems are installed.

Given the current deteriorating world energy situation and the expanding communications market, investment in SWECS will increasingly be made less for testing and demonstration purposes than for serious energy conservation and cost saving goals.

Hybrid systems such as the MCI installation at Kenna are quick, low risk methods of gaining experience with small wind energy conversion systems.

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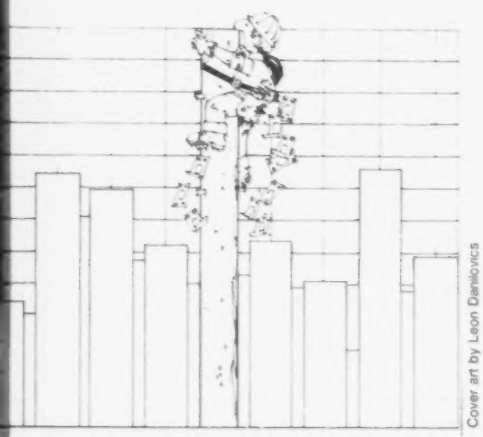
Execs look at the future

'82 telco construction spending increases $1.5 billion—up to record $24.6 billion

LEO ANDERSON, Publisher, and **GERRY BARRETT,** Special Projects Director

U.S. TELEPHONE COMPANIES will spend an estimated $24.6 billion on construction in 1982. This is a new record and nearly $1.5 billion more than 1981. The percentage increase is 6.3%.



Cover art by Leon Danilovics

TELEPHONE COMPANY spending construction will reach an estimated $24.6 billion in 1982, a new industry record.

The Bell System share of that total is $19.18 billion; the Independents', $5.4 billion.

These figures come from American Telephone & Telegraph Co. (AT&T), New York, N.Y., as well as from 23 of the top Independent telephone companies, plus statistical information from the U.S. Independent Telephone Assn. (USITA), whose figures cover 96.6% of the Independent industry. Extrapolation by TELEPHONY results in a reasonably realistic picture of the entire U.S. telephone field.

While AT&T's Bell System obviously still massively dominates the industry, with nearly 80% of the nations's 184.2 million telco-owned phones, the Independents are moving upward at a faster pace by virtually all measurements. The Independent segment's construction spending increase for 1982 over 1981, for example, will be 11.1%, compared to the Bell System increase of 5%. Comparing growth rates of Bell and Independents over the past 5 years, using several yardsticks: in number of telephones, Bell is up 16%, Independents 28%; gross plant investment—Bell up 53%, Independents 70%; annual operating revenues—Bell up 71%, Independents 89%; number of operating company employes—Bell up 13%, Independents 23%. Those employment figures, incidentally, show the Bell System having 875,200 operating company employes (as of Nov. 30, 1981) and Independents having 197,000 employes at year-end, which means that operation of the country's telephone system requires more than 1 million men and women.

The number of telco-owned telephones continues to move upward at a goodly pace despite the fact that a trend begun 4 years ago manifested itself strongly during 1981. That trend: a slowing down of the growth in number of telco-owned telephones. The trend began in '77 in the Bell System and '79

Table 1 Independent and Bell Construction Expenditures

	Independent Telephone Companies (millions of dollars)**			Bell Telephone Companies (millions of dollars)***			Combined Independent & Bell Telephone Companies (millions of dollars)		
	Const. Spending	Increase (Decrease) vs. Previous Year	% Increase (Decrease)	Const. Spending	Increase (Decrease) vs. Previous Year	% Increase (Decrease)	Const. Spending	Increase (Decrease) vs. Previous Year	% Increase (Decrease)
1961	$586	$—	—	$2,759	$—	—	$3,325	$—	—
1964	780	—	—	3,566	—	—	4,346	—	—
1967	1,254	—	—	4,359	—	—	5,613	—	—
1970	1,665	—	—	7,314	—	—	8,979	—	—
1973	2,325	—	—	9,516	—	—	11,841	—	—
1976	2,481	59	2.4	10,044	519	5.5	12,525	578	4.9
1977	2,797	316	12.7	11,793	1,749	17.4	14,590	2,065	16.5
1978	3,471	674	24.1	13,951	2,158	18.3	17,422	2,832	19.4
1979	4,205	734	21.1	16,050	2,099	15	20,255	2,833	16.3
1980	4,544	339	8.1	17,505	1,455	9.1	22,049	1,794	8.9
1981	4,899*	355*	7.8*	18,270*#	765*#	4.4*	23,169*	1,120*	5.1*
1982	5,444*	545*	11.1*	19,180*#	910*#	5.0*	24,624*	1,455*	6.3*

*Estimated
**Source: USITA
***Source: AT&T (Bell Telephone Companies include AT&T, its principal telephone subsidiaries, and Bell affiliates, Southern New England Telephone Co. and Cincinnati Bell, whose common stocks are minority-owned by AT&T.)
#Rounded to nearest 10 million dollars.

Table 2 Independent Telephone Company Statistics

Number of Telephones, United States (000 omitted)

	Year-End Total	Increase
1976	28,209	—
1977	29,675	1,466
1978	31,549	1,874
1979	33,226	1,677
1980	34,665	1,439*
1981	36,084*	1,419*
5-year Growth	7,875=28% of year-end '76	
1982	37,844*	1,760*

Number of Independent Telephone Exchanges

	Year-End Total	Increase
1976	11,040	—
1977	11,045	5
1978	11,053	8
1979	11,050	(3*)
1980	11,040	(10)
1981	11,035*	(5*)
5-year Decrease	−5 of year-end '76	
1982	11,025*	(10)*

Number of Independent Telephone Companies

	Year-End Total	Decrease
1976	1,590	—
1977	1,556	34
1978	1,527	29
1979	1,488	39
1980	1,483	5
1981	1,460*	23*
5-year Decrease	130=8% of year-end '76	
1982	1,435*	25*

Investment in Gross Plant ($000,000 omitted)

	Year-End Total	Increase
1976	$23,000	$—
1977	25,130	2,130
1978	27,788	2,658
1979	31,644	3,856
1980	35,300	3,656
1981	39,181*	3,881*
5-year Growth	$16,181=70% of year-end '76	
1982	43,584*	4,403*

Total Operating Revenues ($000,000 omitted)

	Year-End Total	Increase
1976	$6,300	$—
1977	7,115	815
1978	8,085	970
1979	9,240	1,155
1980	10,475	1,235
1981	11,911*	1,435*
5-year Growth	$5,610=89% of 1976 Revenues	
1982	14,055*	2,144*

Employes

	Year-End Total	Increase
1976	160,000	—
1977	167,000	7,000
1978	179,000	12,000
1979	190,000	11,000
1980	194,000	4,000
1981	197,000*	3,000*
5-year Growth	37,000=23% of year-end '76	
1982	202,000*	5,000*

*Estimated
Source: USITA

among the Independents, as the number of actual phones gained for those years dropped below the gains of the preceding years. Looking back, the Bell System gained 5.78 million phones in 1977 over '76; in '78 the net gain was an even 5 million phones. In '79 and '80 the net gain was down, (see Table 3); too but in the year immediately past, the decline in net gain was precipitous—from 3.56 million in 1980 to 847,000 in '81. Meantime, the Independents gained 1.4 million phones in 1981, which means that for the first time probably since the turn of the century the Independents gained more telephones than Bell. Nevertheless, their net gains have been dropping, too (see Table 2).

This trend is by no means a measure of the relative strength of the industry segments involved, but rather a reflection of increasing customer ownership of telephones fostered by Federal Communications Commission and court actions. The end result is that number of telephones becomes a less meaningful measure than in the past.

Statistics on customer ownership of phones are difficult to come by and those available are far from precise. The Bell System estimates there are 7 million customer-owned residence telephone sets in its operating territories. The spokesman who provided that figure emphasized that a good deal of guesswork went into it and said he could not give a figure for number of business phones that are owned by subscribers.

Other major yardsticks covered in the survey showed that Bell System investment in total telephone plant increased by an estimated $9.8 billion in the 12 months ended Nov. 30, 1981, for an estimated total at that date of $146 billion. Bell estimated operating revenues for '81 were $57.3 billion, up $6.5 billion. Bell gained seven exchanges during the year, the first increase in 5 years. Total number of Bell exchanges was estimated at 6694 at year-end.

Comparable figures on the Independent side show estimated gross plant investment of $39.1 billion at year-end—a gain of $3.88 billion; operating revenues up an estimated $1.4 billion to $11.9 billion (est.); number of exchanges down 5 to a total of 11,035 (est.).

The 23 top Independents taking part in this survey comprise about 96% of the gross plant investment of the Independent segment of the industry, and therefore an examination of which way these leaders are going in terms of their spending for 1982 would be of interest. Statistical details can be examined in Table 6, but here are the highlights of the survey's findings:

1. Fourteen of the 23 companies spent more on construction in 1981 than in 1980. Six companies spent less, and three spent the same amount for both years.

2. Four of the top five companies report increases in construction spending for 1981: 11.6% for Mid-Continent, 4.2% for GTE, 3.6% for Central Tel and 3.3% for United. Continental will spend 4.4% less.

3. Considering the six which reported '81 spending below '80, the decreases range from 18.8% to less than 1%.

4. Of those 14 reporting increased spending, the increases range from 62.7% for Anchorage Tel to 3.3% for United.

5. For 1982, 16 companies reported higher construction budgets than '81; 6 reported lower budgets and one will remain the same. Increases range from 37.2% to 1.6%, while decreases are from 34.6% to 1.8%.

6. Four of the top five companies are estimating increases in construction spending for 1982—United up 12.6%, Continental up 10.2%, Central up 1.6%, and Mid-Continent up a whopping 25.9%. GTE projects the same amount of construction spending in 1982 as in 1981.

7. For 1983, the 23 companies are almost evenly divided—12 will increase spending over 1982, and 13 will not spend as much as in 1982. Increases range from 52% to 1.8% and decreases are from 44% to 4%. All top five companies project increases: 8% for GTE, 4.4% for United, 5.8% for Continental, 13.4% for Central and 5.9% for Mid-Continent.

Once again the number of Independent telephone companies declined—from 1483 at the end of '80 to 1460 as of Dec. 31, 1981. (Figures for both years are estimated.) This decline is part of a longstanding trend, and it likely will continue, although at an ever slower pace, as the size of the field in number of entities constricts.

Even more important changes are taking place within the various major companies in the field; although they have not yet jelled enough to quantify. Bell, for example, has plans for substantial

'It is pretty clear by now that debate on the issues in the business in every public forum presages some form of deregulation. The key question that must be answered is what form deregulation will take.'

consolidation of functions among operating companies even though the territorial divisions and corporate entities remain. General Telephone & Electronics, the largest of the Independents, has moved even further, to the point of consolidating corporate offices and officers for a number of its operating companies.

These actions, and other sweeping actions by other companies, are products of the rapidly changing structure of the industry. A major catalyst to this change is the increasingly unregulated aspect of the industry, with deregulation happening piecemeal even as most of the field awaits the true and final definition of just what form deregulation will take.

A major part of TELEPHONY's survey was a request that telcos answer the question: "What have been the major effects of deregulation on your company's planning?" Answers came from 13 companies representing the giants—AT&T, GTE, United—as well as some of the smaller of the leading Independents—Denver and Ephrata Tel, and North Pittsburgh Tel. The answers are interesting because of the variety of companies responding, but more especially for the different tacks taken by the respondents. Some emphasized the mysteries of deregulation; others, the risks; still others, the opportunities; and many, a combination of all three.

It cannot be said that any one statement is typical of the whole, but we view United Telecom Chairman Paul Henson's as something of a summation, and have, therefore, used it as our Guest Editorial in this issue (p. 23).

The most succinct response came from Royster M. Tucker Jr., president of North State Telephone Co., High Point, N.C., who said deregulation has affected three areas of company planning: "We plan to strengthen and streamline sales and marketing methods...We plan to further diversify and broaden offerings of terminal equipment...We foresee expanding the scope of technical training in the business communications area of operations."

Here are the statements from the other companies participating:

Anchorage..."not unsinkable." Your question, "What have been the major effects of deregulation on your company's planning?" is certainly provocative, even if difficult to quantify.

It's provocative in that deregulation touches almost every aspect of a local utility's operation, even though supposedly limited to customer premises equipment (CPE). I think almost everyone in telephony certainly realizes by now that CPE is simply the tip of an iceberg that can inflict severe economic harm upon a utility's customers should proper courses of action and planning not be prudently selected for the coming years.

The effects of deregulation are difficult to quantify due to all the uncertainties that exist today. Current FCC [Federal Communications Commission] dockets and Joint Board procedures along with proposed legislation in both the U.S. Senate and House of Representatives spew forth a multitude of varied concepts on the proposed breadth and extend to which deregulation should take effect. It is virtually impossible to quantify all the varied ramifications that may result from each approach and how they interrelate to each other.

The most effective approach to future planning that we have right now is vigorous participation in these ongoing procedures to the maximum extent possible. It is our primary purpose in these efforts to illustrate the positive and negative effects various proposals have upon a typical Independent telephone utility such as ours and the alternative approaches that exist to offset these effects while still attaining the original goals of deregulation. In this way we hope to shape the future plan rather than simply plan for alternative futures.

It is our firm belief that the Independent telephone utility is *not* unsinkable and that only through active participation with others in plotting new courses will we arrive intact at our destination: universal availability of basic telephone service at reasonable charges. *A.C. Pistorius, General Manager, Anchorage (Alaska) Utility.* □

AT&T..."uncertainty." To date, the major effect of deregulation on AT&T's

Table 3 Bell System Statistics**

Number of Telephones*
(000 omitted)

	Year-End Total	Increase
1976	126,612	—
1977	132,397	5,785
1978	137,478	5,081
1979	142,310	4,832
1980	145,876	3,566
1981	146,723‡	847‡

5-year Growth
20,111 = 16% of year-end '76

Investment in Total Telephone Plant
($000,000 omitted)

	Year-End Total	Increase
1976	$95,798	$—
1977	103,576	7,778
1978	112,989	9,413
1979	123,867	10,878
1980	136,524	12,657
1981	146,310 †	9,786†

5-year Growth
$50,512 = 53% of year-end '76

Bell System Exchanges

	Year-End Total	Increase/ Decrease
1976	6,713	—
1977	6,711	−2
1978	6,705	−6
1979	6,693	−12
1980	6,687	−6†
1981	6,694‡	+7†

Operating Revenues
($000,000 omitted)

	Year-End Total	Increase
1976	$33,493	$—
1977	37,247	3,754
1978	41,945	4,698
1979	45,408	3,463
1980	50,791	5,383
1981	57,298‡	6,507‡

5-year Growth
23,805 = 71% of year-end '76

Operating Company Employes

	Year-End Total	Increase/ Decrease
1976	777,721	—
1977	785,378	+7,657
1978	823,159	+37,781
1979	855,309	+32,150
1980	867,835	+12,526
1981	875,200‡	+7,365‡

5-year Growth
97,497 = 13% of year-end '76

*Bell System includes AT&T, its principal telephone subsidiaries, and Bell affiliates (Southern New England Telephone Co. and Cincinnati Bell) whose common stocks are minority-owned by AT&T.
**Includes Bell Service Telephones
†Estimated
‡As of Nov. 30
Source: AT&T

Table 4 Independent Telephone Company Composite Plant Statistics ($000,000 Omitted)

Buildings

	Year-End Total	Increase
1975	$1,344.8	$—
1976	1,439.4	94.6
1977	1,523.4	84
1978	1,644.3	120.9
1979	1,825.8	181.5
1980	1,976.3	150.5

5-year Growth
$631=46.9% of year-end '75

Underground Cable

	Year-End Total	Increase
1975	$841.1	$—
1976	910.1	69.0
1977	975.5	65.4
1978	1,081.5	106.0
1979	1,245.2	163.7
1980	1,373.9	128.7

5-year Growth
$532.8=63% of year-end '75

Large Private Branch Exchanges

	Year-End Total	Increase
1975	$531.3	$—
1976	598.5	67.2
1977	660.3	61.8
1978	726.2	65.9
1979	853.3	127.1
1980	906.3	533

5-year Growth
$375=70.5% of year-end '75

Aerial Cable

	Year-End Total	Increase
1975	$2,216.8	$—
1976	2,359.5	142.7
1977	2,516.4	156.9
1978	2,697.6	181.2
1979	2,978.9	281.3
1980	3,190.7	211.8

5-year Growth
$973.9=43.9% of year-end '75

Station Apparatus

	Year-End Total	Increase
1975	$1,905	$—
1976	2,058.3	153.3
1977	2,275.4	217.1
1978	2,536.4	261.0
1979	2,918.6	382.2
1980	3,027	108.4

5-year Growth
$1,122=58.8% of year-end '75

Underground Conduit

	Year-End Total	Increase
1975	$518.6	$—
1976	566.5	47.9
1977	606.8	40.3
1978	664.5	57.7
1979	765.8	101.3
1980	863.9	98.1

5-year Growth
$345.3=66.5% of year-end '75

Central Office Equipment

	Year-End Total	Increase
1975	$6,763	$—
1976	7,542.8	779.8
1977	8,169.8	627
1978	8,963.8	794
1979	10,128.4	1,164.6
1980	11,146.2	1,017.8

5-year Growth
$4,383.2=64.8% of year-end '75

Buried Cable (Plowed In)

	Year-End Total	Increase
1975	$2,393.3	$—
1976	2,851.2	457.9
1977	3,219.4	368.2
1978	3,654.5	435.1
1979	4,165.9	511.4
1980	4,740.6	574.7

5-year Growth
$2,347.3=98.1% of year-end '75

Vehicles, Other Work Equipment

	Year-End Total	Increase
1975	$365.1	$—
1976	404.4	39.3
1977	459.9	55.5
1978	550.6	90.7
1979	641	90.4
1980	700.2	59.17

5-year Growth
$335.1=91.7% of year-end '75

Source: USITA (Extrapolated by TELEPHONY to 100% of Independent companies.)

planning has been to raise the level of uncertainty in which we must operate. And while uncertainty is to some degree always part of the planning process, this is especially true in today's transition to a partially deregulated industry.

The factor that really muddies the waters for us is that there are few "givens" on which to base our planning. Chief among the missing elements are the operating ground rules that eventually will emerge from the resolution of legislative action and appeals from the FCC's Second Computer Inquiry orders.

It is pretty clear by now that debate on the issues of the business in every public forum presages some form of deregulation. The key question that must be answered is what form deregulation will take.

In planning, we have tried to anticipate a reasonable outcome, and we have tried not to go out too far on a limb. We have been working on the widely-accepted perception that the Bell System will be permitted a level of participation in unregulated markets; the ticket for entry, of course, is going to be some level of restructuring of our company's business.

What we cannot do, however, is sit back and wait for the decisionmakers to dot every "i" and cross every "t" of the evolving groundrules. We must go about our business in a way that we think will fit the likely requirements of deregulation and rapidly changing technology while meeting the emerging demands of the marketplace. That course can be seen in our recent announcement for the initial capitalization of our new fully separated subsidiary to offer Advanced Communications Service.

L.S. Cutcliff

If there is one remaining certainty in our planning, it is this: we intend to bring into the new environment the service concept that has proven so valuable in the past and the unswerving commitment to meet customer needs one by one. We see no distinction between the regulated and deregulated sectors in that regard, and we will draw no distinctions between service and marketing. It's pretty clear to us that customer needs are becoming increasingly individualized; our primary goal in planning is to meet these expectations.—*Lee Cutcliff, Assistant Vice President-Strategic Planning, American Telephone & Telegraph Co. (AT&T), New York, N.Y.* □

GTE..."opportunity." The introduction of deregulation into the telecommunications industry is creating two important areas of opportunity that are receiving extensive consideration in the future-planning programs at GTE.

These areas are: planning to provide regulated services in the competitive environment; and planning to participate in deregulated or "lightly regulated" businesses.

Historically, telephone companies have focused their planning activities on quality of service, market growth, intro-

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Table 5 Bell System Composite Plant Statistics ($000,000 omitted) (source AT&T)

Buildings

	Year-End Total	Increase
1975	$8,266	$—
1976	8,950	684
1977	9,553	603
1978	10,080	527
1979	10,680	600
1980	12,117	1,437

5-year Growth
$3,851=47% of year-end '75

Buried Cable (Plowed In)

	Year-End Total	Increase
1975	$6,593	$—
1976	7,357	764
1977	8,283	926
1978	9,421	1,138
1979	10,735	1,314
1980	12,078	1,343

5-year Growth
$5,485=83% of year-end '75

Large Private Branch Exchanges

	Year-End Total	Increase
1975	$3,167	$—
1976	3,230	63
1977	3,256	26
1978	3,300	44
1979	3,385	85
1980	3,495	110

5-year Growth
$328=10% of year-end '75

Central Office Equipment

	Year-End Total	Increase
1975	$33,098	$—
1976	35,351	2,253
1977	37,714	2,363
1978	40,403	2,689
1979	43,140	2,737
1980	46,468	3,328

5-year Growth
$13,370=40% of year-end '75

Underground Cable

	Year-End Total	Increase
1975	$5,864	$—
1976	6,262	398
1977	6,760	498
1978	7,393	633
1979	8,189	796
1980	9,146	957

5-year Growth
$3,552=61% of year-end '75

Vehicles & Other Work Equipment

	Year-End Total	Increase
1975	$1,122	$—
1976	1,225	103
1977	1,365	140
1978	1,548	183
1979	1,852	304
1980	2,101	249

5-year Growth
$979=87% of year-end '75

Aerial Cable

	Year-End Total	Increase
1975	$6,673	$—
1976	7,126	453
1977	7,659	533
1978	8,258	599
1979	8,950	692
1980	9,798	848

5-year Growth
$3,125=47% of year-end '75

Underground Conduit

	Year-End Total	Increase
1975	$3,975	$—
1976	4,266	291
1977	4,646	380
1978	5,189	543
1979	5,873	684
1980	6,617	744

5-year Growth
$2,642=66% of year-end '75

Station Apparatus

	Year-End Total	Increase
1975	$6,636	$—
1976	7,238	602
1977	8,039	801
1978	9,026	987
1979	9,889	863
1980	10,875	986

5-year Growth
$4,239=64% of year-end '75

Total Station Equipment

	Year-End Total	Increase
1975	$16,769	$—
1976	18,117	1,348
1977	19,835	1,718
1978	21,974	2,139
1979	24,372	2,398
1980	27,117	2,745

5-year Growth
$10,348=62% of year-end '75

duction of new services and new technology, capital requirements and control of costs. Without question, these matters will continue to be important concerns after Jan. 1, 1983.

With the advent of deregulation, two new areas of importance to planners have arisen: planning for the GTE telephone companies' involvement in providing deregulated customer premises equipment; and planning for providing network services in the face of expensive and steadily increasing competition.

Plans to provide deregulated CPE must ensure the orderly withdrawal from the provision of such equipment on a regulated basis in a manner which will cause the least possible disruption to customers while recovering the investment GTE has made under regulation. The company intends to be an active participant in the FCC's "CPE implementation proceeding" to establish the orderly withdrawal of telephone companies from the regulated provision of CPE.

Since GTE is a non-dominant carrier, our telephone companies will be allowed to provide new, deregulated CPE on a going-forward basis. Accounting and operational procedures will assure that these deregulated activities are not subsidized by the regulated side of the business.

The provision of network services on a competitive basis is a matter of vital concern to GTE. We firmly believe that economically integrated network services should continue to be made available to all customers at the lowest possible prices. However, we will have difficulty competing with the other common carriers that do not have the same cost allocation burdens that must be borne by telephone companies. We are therefore looking at various ways that will enable us to compete on a sound economic footing in these areas.

Competition and deregulation present several opportunities for GTE to offer both deregulated and lightly regulated products and services. As far as the deregulated offerings are concerned, GTE is, and will continue to be, a principal provider of customer-owned CPE. In the deregulated environment, it will be possible to offer a number of telecommunications products and services on a lightly regulated or perhaps completely unregulated basis.

With the sweeping changes brought about by deregulation and the new competition now evolving, the planning abilities of all of us in GTE are challenged to a very great degree. We are stimulated by these challenges and intend to continue GTE's role as a foremost provider of telecommunications products and services.—*Theodore F. Brophy, Chairman and Chief Executive Officer, General Telephone & Electronics Corp. (GTE), Stamford, Conn.* □

Lincoln Tel & Tel. . . "several external variables." Some of the most dramatic effects of deregulation to date have occurred and continue to occur in our company's planning efforts. Prior to the first hints at deregulation, planning at LT&T primarily consisted of developing operational plans that dealt with the incorporation of new technology, service improvements or the provision of new services.

The process by which these operational plans were developed was typically a series of "studies" evaluating the major technical and financial alternatives. Although occasionally an external variable would slip into these "studies," given the context of monopoly regulation and the traditional role of end-to-end responsibility, the external environment was often not a major consideration.

Deregulation, because it represents a major change in the environment in which we conduct our business, has forced the addition of several external variables to operational planning and has added a new front-end function to

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Table 6 Construction Spending of Major Independents, plus other '81 Year-End Estimated Figures (dollar figures are in millions)

Company	No. of Stations	Plant Investment	Operating Revenues ('81)	Construction Expenditures			
				Spent 1980	Budgeted or estimated		
					1981	1982	1983
General Tel. & Electronics Corp.	16,300,000	$17,800.0	$5,800.0	$2,400.0	$2,500.0	$2,500.0	$2,700.1
United Telecom, Inc.	4,837,000	5,092.0	1,642.0	569.0	588.0	662.0	691.0
Continental Tel. Corp.	2,060,600	3,617.0	1,195.0	408.0	390.2	430.0	455.1
Central Tel. & Utilities Corp.	1,722,116	1,845.0	634.5	192.0	198.9	202.0	229.0
Mid-Continent Tel. Corp.	1,150,000	1,141.0	286.0	96.8	108.0	136.0	144.0
Rochester Tel. Corp.	596,201	560.0	201.2	41.6	49.9	46.2	41.3
Lincoln Tel. & Tel. Co.	338,900	326.2	108.0	31.7	38.4	39.1	42.5
Century Tel. Ent., Inc.	289,000	293.0	112.0	34.5	28.0	31.5	33.6
Telephone & Data Sys., Inc.	249,350	216.0	55.2	19.8	20.7	28.4	25.3
Commonwealth Tel. Co.	240,874	206.8	49.3	18.3	16.3	16.7	15.9
Telephone Utilities, Inc.	208,000	214.0	75.8	36.7	34.0	38.0	36.0
Allied Tel. Co.	208,000	231.0	58.5	22.0	22.0	26.0	30.0
Anchorage Tel. Utility	153,240	192.0	62.9	23.3	37.9	24.8	23.8
Illinois Consolidated Tel. Co.	126,000	109.8	40.8	8.8	14.1	19.9	17.5
North State Tel. Co.	115,015	68.4	22.1	5.7	5.7	5.6	5.7
Citizens Utilities Co.	108,024	208.4	60.0	33.5	33.3	36.5	33.6
The Concord Tel. Co.	97,775	59.2	19.4	4.6	5.9	5.0	5.5
Roseville Tel. Co.	78,700	64.9	22.5	11.2	12.2	12.5	10.4
North-West Tel. Co.	75,500	75.7	22.0	7.0	10.9	11.8	10.9
Universal Tel. Inc.	58,100	60.3	16.2	7.9	9.5	8.7	4.8
Denver & Ephrata Tel. & Tel. Co.	53,900	34.4	9.1	2.4	2.4	3.2	2.6
North Pittsburgh Tel. Co.	54,300	50.9	16.4	5.3	4.7	5.2	5.7
Mankato Citizens Tel. Co.	47,528	39.4	11.7	2.6	3.0	2.5	3.8

Table 7 Construction Expenditures by Bell Telephone Companies* (dollar figures are in millions)

Company	Total Telephones as of Nov. 30, 1981	Plant Invest. ($M) 10 Months Ending Oct. 31, 1981 (1)	Operating Revenues 12 Months Ending Nov. 30, 1981 ($M)	Construction Expenditures ($M)		
				Spent 1980 (2)	Budgeted 1981 (1)	1982 (1)
New England	7,118,000	$6,480	$2,465	$682	$710	$800
New York	11,709,000	13,380	5,435	1,285	1,380	1,510
New Jersey	6,602,000	5,210	1,938	579	650	650
Pennsylvania	8,509,000	6,170	2,156	710	650	670
Chesapeake & Potomac	8,801,000	7,850	2,754	910	930	1,010
Southern	13,037,000	12,830	4,686	1,829	1,750	1,780
South Central	10,684,000	10,570	3,740	1,308	1,310	1,390
Ohio	5,014,000	3,970	1,559	416	440	450
Michigan	6,292,000	5,210	1,834	569	520	500
Indiana	2,638,000	2,150	782	209	200	210
Wisconsin	2,369,000	2,000	721	207	210	210
Illinois	8,496,000	6,370	2,489	684	650	670
Northwestern	5,667,000	5,440	1,863	593	560	590
Southwestern	17,008,000	16,620	6,173	2,207	2,220	2,440
Mountain	8,087,000	8,020	2,881	1,063	1,250	1,440
Pacific Northwest Bell	3,868,000	4,050	1,449	563	530	560
Pacific T&T	16,637,000	17,850	6,151	2,420	2,670	2,630
Long Lines	—	9,020	—	948	1,290	1,430
Bell System	142,536,000	143,190	—	17,182	17,920	18,880
Southern New England	2,617,000	2,200	857,000	221	230	210
Cincinnati	1,209,000	920	325,000	102	120	90
All Cos.	146,362,000	146,310	50,258	17,505	18,270	19,180

(1) Rounded to nearest ten million dollars
(2) Rounded to nearest one million dollars

* "Bell Telephone Companies" includes AT&T, its principal telephone subsidiaries, and Bell affiliates (Southern New England Telephone Co. and Cincinnati Bell) whose common stocks are minority-owned by AT&T.
Source: AT&T

the planning process. This new front-end function, commonly referred to as strategic planning or corporate development, asks the classical question: What businesses are we in? What are our strengths and weaknesses? What businesses do we want to be in? These questions and others like them were academic in the pre-deregulation era, but are now fundamental to the orderly growth of the company. The answers to these questions serve as the basis for operational planning.

In the past a telco manager could describe where the company was headed in terms of its operational plans. Today that manager needs to know the company and its environment well enough to plot a course before those operational plans are developed.—*James E. Geist, Executive Vice President, Lincoln (Neb.) Telephone & Telegraph Co. (LT&T).* □

J.E. Geist

North Pittsburgh Tel ..."diversification." Basically, deregulation has forced our company to plan a course of diversification in order to assure continuing profitability. As deregulation progresses and the cross-subsidies from toll to local service and business to residential service are reduced or eliminated, the stark reality of a marginal basic telephone operation becomes an increasing possibility. The zeal of Congress and the government bureaucracy to reduce the Bell System to impotence, as they reduced the railroads one-half century ago, presents a formidable problem, particularly to non-affiliated telephone companies.

It becomes increasingly obvious that the local telephone company must diversify and seek unregulated activities that can produce returns to compensate for the reduced profitability of the local exchange service that remains. The slogan "SPF [subscriber plant factor] to SLU [subscriber line usage] in '82" signals the necessity to revise local rates to price each service to be fully compensatory, eliminating the station investment, and adds to the problem. State and federal regulatory bodies can be depended upon to fight a delaying action which, if not anticipated, may add to the distress of the smaller companies.

While we are facing definite perils, we are also facing new opportunities. Being able to recognize the good ones, and to make timely moves to exploit them, is our most important current challenge.

Our company was among the first to unbundle its rates and arrange to sell terminal equipment. Serving a bedroom community with no central retail center has proven to be a difficult problem with which to cope. There is no single phone store location to command our customers' attention. This seeming disadvantage has only been partially offset by indirect methods of selling.

More important has been the establishment of an interconnect subsidiary. So far, the subsidiary has been staffed by contracting the services of the telephone company personnel. Added emphasis in the marketing area has developed a very flexible approach to contracting by direct lease, third party leasing, lease-purchase, and outright sale of PABX [private automatic branch exchange] equipment, key systems and a variety of more specialized communication devices. While we have used the telephone company alone within our franchised service area, the subsidiary has been used outside of our area. We have not hidden our telephone company identity, even with the subsidiary, and we have found that with the recent demise of several interconnect companies in our area, the fact that, as a telephone company, we cannot pick up our tent and move overnight, our potential stability is an attractive competitive advantage.

With the advent of the computerized office we are preparing ourselves to offer systems which go beyond the conventional key telephone or PABX. We are convinced that there is a tremendous potential market for that activity, and that our experience and background assist us in effectively moving into that expanding field of endeavor. Total communications is no longer just a buzz word.

There seems to have been a natural involvement in pursuing these new markets for the telephone company and, particularly its subsidiary, to become a distributor of equipment, not only for our internal use, but also to other telephone and non-telephone communication equipment users. The application expertise inherent in the telephone operating business has been a catalyst for the distribution activity.

By far the most serious challenge to us is the potential loss of toll settlement support. Our company is an atypical Independent to the extent that two-thirds of our revenues are derived from toll. Any loss of toll business or reduction in settlement requires a serious shift of support to our local rate structure, which cannot be brought about overnight. Being close to a metropolitan area we decided to file an access tariff in order to provide at least a minimum of threshold of protection. At the same time we are investigating possible interchange of traffic with one or more of the OCCs [other common carriers] as well as the possibility of entering the business as a reseller. Both of these possibilities are fraught with complexities, not the least of which are the encumbrances imposed by the FCC on an Independent telephone company, which they have decreed to be a "dominant carrier" (We are still looking for those we are supposed to dominate.) Being ensnared in the ponderous and slow moving FCC certification and tariff-filing processes, not equally imposed on the competition, places an Independent telephone company and its subsidiary at an inflexible disadvantage.

Having been forced 8 years ago by the FCC to divest ourselves of a profitable CATV [community antenna television] business, we now are overbuilt by four CATV networks. The evolution of technology makes these systems, along with rooftop antennas, increasingly potent competitors to our local distribution system. The emerging cellular radio technology, however, presents yet another distribution means which the telephone industry cannot afford to overlook. So far, the technology is priced beyond the reach of small, less dense systems but, with our Independent neighbors, we are investigating the economic feasibility and potential market of a joint operation which may allow our early entry into this promising new communication medium, which is not limited just to vehicular applications, in our opinion.

We have investigated, or are currently investigating, the provision of other communication services, such as secretarial answering, provision of alarm systems, the operation of alarm and security services, and performing consulting and contracting services. While we are

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trying to move as rapidly as possible into these new areas of endeavor, we are doing so somewhat conservatively so that we are not overextended and can take a high quality, rather than simply a cut rate, approach. In other words, we intend to protect, and at the same time exploit, our reputation as a good, dependable telephone company. In this manner we intend to continue to keep our subsidiary's figures colored black.—*F.D. Reese, President and General Manager, North Pittsburgh Telephone Co., Gibsonia, Pa.* □

F.D. Reese

Continental Tel...''dynamic strategic planning.'' Deregulation certainly has been a most prominent ingredient in our strategic long-range planning process. History may record the deregulation movement as the most significant change in the telecommunications industry since the 1934 Communications Act.

The ball is just off the tee, it's a solid hit, and the direction is clear. How far the deregulation movement will go is steadily coming into sharper focus. Ultimately, there may be no segment of the telecommunications market immune to competition.

Coincident with the beginning of deregulation, the telephone industry was approaching a high level of market saturation. With growth limited, market share fixed by franchised boundaries and the prospect of deregulation, the natural reaction was to take a defensive posture. Our strategic planning process led us to adopt the opposite attitude.

As the last major entrant in the traditional telephone market, we very rapidly captured share enough to become the third largest independent in the country. But, this still represented less than 2% of the market. We viewed deregulation as a means of invading portions of the 98% from which we previously had been excluded.

A major result of the positive planning process was to define our business as a broad based telecommunications business rather than simply a telephone company. This was supported by a carefully planned acquisition and joint venture strategy that could provide the vehicles to transform the company into a sophisticated supplier of data and voice communications services. Already, Continental has made a number of acquisitions and joint venture investments that provide all of the major pieces that the company will need to become a major supplier of such services to the business community.

The positive approach to planning was carried through in regard to the more specific, contemporary issues of deregulation, such as terminal equipment and inside wiring. While the planning process has necessarily become more complex in the short term as a result of the state commissions' various attitudes and rates of evolution to deregulation, the longer term spirit of a competitive environment remains: deregulation suggests customers will have a choice and companies will have a choice as to which segments of the market in which to participate. Working from within its franchised bases, a strategic marketing plan has been developed which includes very aggressive pursuit of selected business terminal equipment markets that offer significant profit potential while adopting a passive approach in less fertile markets. Ultimately, Continental will withdraw entirely from some of these traditional markets.

Similar planning in regard to the residential terminal equipment and inside wiring markets suggests that traditional methods of serving many of these markets will not be profitable on a stand-alone basis. These effects of deregulation have tremendous implications in planning for redeployment of resources.

The opportunities to shed some loss operations puts the company in a better position to be competitive with any potential alternative suppliers of basic access service. The planning process necessarily includes constant monitoring of state-of-the-art technology for any economically viable alternatives for serving the local loop. As a telecommunications company, instead of a telephone company, Continental expects to be positioned to apply any such technologies as rapidly and effectively as anyone.

Deregulation has made a dynamic strategic planning process an essential and fundamental function in the operation of the business.—*James V. Napier, President, Continental Telephone Corp., Atlanta, Ga.* □

J.V. Napier

Centel...''growth and profit.'' Since the mid-'70s, Centel has recognized that many aspects of the telephone industry might be deregulated and has charted its course accordingly. Our more than one-half decade of competitive marketing experience is a major reason why we're achieving our growth and profit objectives, while at the same time minimizing the negative effects deregulation may cause our customers and employes.

Without underestimating the profound changes—which may well be as sociological as financial—deregulation will have on the industry as well as Centel, we've already taken the basic steps that will determine the Centel of the future. We've made bold entries into certain non-regulated businesses, like cable television and business systems marketing, while concurrently modernizing and streamlining our telephone operations to fit the communications needs of contemporary and future society.

Our approach to the acquisition and development of businesses outside the realm of regulated telephone operations began prudently to give our management hands-on experience in a competitive arena with minimal risk to the company. From the modest beginning, however, the company's non-regulated businesses continue to grow, and we expect their contribution to be 25% of earnings by 1985.

For example, next year Centel Business Systems will expand its marketing efforts by opening sales offices in major markets across the country, outside our regulated operations' serving areas. We

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continue to add cable television franchises and expect to have 500,000 cable customers by 1985, up from the 12,000 of a couple of years ago and somewhat more than the 100,000 now.

With revenues of $634.5 million projected for 1981, regulated telephone operations continue to be the heart of our business. Thus, we're accelerating programs with the potential of replacing revenues we predict will be lost through terminal equipment deregulation and changes in toll subsidization in the years to come. Paramount to these are electronic central office conversions which not only make revenue-producing programs like custom-calling readily available but improve productivity as well.

By year-end 1981, 87 of the company's 371 central offices were fully electronic, with 70 being digital. By the end of 1982, one-third of the central offices will be electronic, and nearly 85% of these will be digital.

In the late '70s, Centel pioneered the concept of encouraging customers to become directly involved in the distribution and installation of terminal equipment. Activities like pick-up and return and do-it-yourself inside wiring installation have effectively reduced labor expenses in addition to smoothing the way to direct sale of residential terminal equipment.

Negative customer response to our decisions to reduce the leased product line severely and in some states eliminate extension leasing altogether has been minimal largely because in addition to new equipment, we sell refurbished and in-place telephones at substantially reduced prices. The sale of refurbished equipment also has proved to be an effective excess inventory control device, too.

For the future we don't foresee any magic single program that will recover all lost revenues. Hence, we're testing a variety of new programs, like the sale of toll gift certificates and statement marketing, that can each generate a portion. Others like videotex, resale of WATS [wide area telecommunication service] and cellular mobile telephone service are being analyzed to see what real benefits they might contribute.

We are expanding our local measured service [LMS] program into additional states in 1982. LMS is essential if we are to keep local service rates affordable and compete with other forms of local distribution networks at the same time.

Finally, we're heartened by the apparent mood of Congress to pass definitive communications legislation in the near future. Whether deregulation is phased in or flash-cut, we will continue to vigorously pursue policies which provide equitable capital recovery rates and a realistic transfer price mechanism and amortization of unrecoverable terminal investment.

Deregulation already has opened exciting new opportunities for Centel and its people. We confidently look forward to more.—*B.J. Whicker, General Staff Manager-Public Relations, Central Telephone & Utilities Corp. (Centel), Chicago, Ill.*

Mid-Continent..."transitional." Mid-Continent Telephone Corp. is in the process of developing a transitional program which will be necessary to successfully accommodate the move from a regulated to a deregulated telecommunications industry.

The communications-related businesses that we have moved into as a result of FCC decisions, and those that someday we will move into, have a common thread—a solid opportunity for long-term profitable growth.

In 1977 we entered the interconnect business with Mid-Continent Communications Corp. (MCC), our subsidiary responsible for the sale of business telephone equipment to users who choose to own rather than lease their equipment. MCC has been a highly successful operation which is expected to become more and more active in the telecommunications changes that are occurring and will occur as we embark upon the environment of deregulation.

To enhance the residential market, we have opened and continue to open retail telephone sales outlets, called Conversation Stations, which allow customers to purchase or lease phones of more than 100 different designs and colors.

On the international front, we have organized Mid-Continent Telephone Consulting Services Div. to bolster the company's international efforts. We are currently involved in telecommunications consulting work in Bangkok, Thailand, and Yanbu, Saudi Arabia.

In addition to the communications-related businesses, deregulation is also having a considerable impact on Mid-Continent's rate structure. In earlier times, the telephone industry kept initial charges for phone service low to encourage new installations. But since telephone service is practically universal, and competition has increased, charges will necessarily be adjusted to meet actual costs. Since we will no longer spread installation costs to all customers over a period of years, the first occupant of a new phone or office will bear the greatest burden of cost.

Other rate changes are likely in the area of usage pricing. Telephone service has been based on availability, but metering usage is the pricing approach of the future.

To meet the future challenges of deregulation, Mid-Continent will continue to explore the many opportunities available to us in the vast realm of telecommunications while keeping our two-fold objective unchanged: to provide reliable, innovative telecommunications services at a reasonable price and to reward shareholders with increasing earnings and dividends.—*Weldon W. Case, President, Mid-Continent Telephone Corp., Hudson, Ohio.*

W.W. Case

Allied Tel..."drastic change." Historically, the factors affecting business planning have been primarily related to the economy and technological advances. These are still important contributors to the activities of telephony corporate planners, but for the last several years the greatest single impact has unquestionably come from deregulation.

Every phase of operations planning has been touched by present or potential drastic change. Throughout each company, all levels of management are finding that regular revision of goals and objectives is necessary. More than anything else to date, *uncertainty* has been the product of deregulation in relation to planning. Such uncertainty in turn causes the scope of planning to shorten, and has enlarged the importance of in-house financial and legal expertise. No telco in recent years has had the luxury of conducting true long-range planning with much confidence. In lieu of service-

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at-all costs which the telephone industry has been known for in the past, new approaches must be taken toward expenses and revenues. It appears that different emphasis must be placed on the recovery of expenses for adequate returns on investment.

Revised methods are in order for such things as reaction time to customer desires, services offered on-premise as opposed to the business office, and marketing activities. Personnel must be retrained for skills other than those required in the past, with sales being in the forefront. It is important for each telephone company to maximize the ways to effectively compete with others by taking advantage of strengths and improving weaknesses.

At Allied, we have tried to stay in close touch with governmental actions, industry opinions and customer concerns in order to react appropriately to the issues arising from deregulation. We earnestly want to provide services and products that meet the needs of the times we are operating in, and secure a reasonable return for our investors. The uncertainty of congressional action and FCC and state regulatory body directives, however, has presented us and all other telephone companies with unprecedented challenges.

We will continue to plan and react to the situations facing us to the best of our ability and become a strong competitor in the new marketplace.

From today's uncertainties will come tomorrow's opportunities.—*Joe T. Ford, President and Chief Executive Officer, Allied Telephone Co., Little Rock, Ark.* □

North-West Tel..."diversification." Since deregulation was announced in the telephone industry, our company has developed a program of diversification in various fields of communications. Two years ago, we embarked on the first step of this program by seeking cable television franchises in Wisconsin. A wholly-owned subsidiary, Nor-Com Video, Inc., was formed for this venture. We have been successful in a number of communities. Three systems have been built to date, and another system has been acquired in Minnesota. Franchises are being pursued in a number of other communities in Wisconsin and Minnesota.

In addition to cable television, we are also making plans to expand data processing services which we provide to other Independent telephone companies through our wholly-owned subsidiary, North-West Services Corp. These plans include on-line, interactive data services, provision of terminals and other computer hardware with enhanced software applications. Applications also will be studied for other industries.

While we pursue diversification in other areas of communications, we plan to maintain the growth of our telephone business. We view telephony as a maturing industry with more than 95% of American households receiving telephone service. However, there are opportunities to provide new products and services such as custom calling services and network communications packages which can be provided. The deregulation of terminal equipment also will provide new opportunities. A decision is expected from the Wisconsin Public Service Commission which will authorize direct sale of equipment by telephone companies. Our plans for the sale of telephone equipment are awaiting this decision. Selective acquisition of telephone property also will be considered when they fit into an efficient operating plan. Other services to the Independent telephone industry also are under consideration.

Other opportunities also are being studied in data, voice and video communications. In order to accomplish this broad diversification, a holding company is being formed. There will be opportunities for telephone companies in the 1980s in spite of competition and deregulation. North-West plans to take advantage of these opportunities.—*Harry W. Wellenkotter, President, North-West Telephone Co., Tomah, Wis.* □

H.W. Wellenkotter

Denver and Ephrata..."impossible to formulate operating policies." The deregulation which has been brought about by regulatory changes has made it impossible to formulate operating policies with any degree of faith that they will stay in effect for any period of time.

Currently, our position is to discourage the purchase of terminal equipment by our subscribers and to encourage our customers to lease their equipment from us based upon our established tariff rates. To this end, we feel that we have been relatively successful. The small subscribers save very little when purchasing their own equipment and encounter problems when trying to get the equipment repaired on a timely basis by the vendor or the manufacturer. In addition, they are subject to a service charge if we are called out first, and in most cases we are, and find out that the problem is with their equipment. Our company has had a history of providing prompt repairs and excellent service to our customers, and we plan to continue these procedures. For this reason the major customers in our service area have been inclined to either continue leasing our equipment or have purchased their equipment from us with an associated maintenance contract.

Based on the rules now in effect, we intend to continue these policies until Jan. 1, 1983, at which time, if the date has not been extended, and if we are permitted by the then current regulations, we will offer all of our subscribers the option to purchase their terminal equipment. However, we will continue to encourage them to lease their terminal equipment because we feel in this way they will continue to receive the most modern and efficient telephone service available at the least cost to them in the long run.—*Bertha B. Blair, Chairman and President, Denver and Ephrata Telephone and Telegraph Co., Ephrata, Pa.* □

B.B. Blair

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telephony

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Non-U.S. telecom spending hovers at $52 billion, a slight increase

DAN S. FARGO, PRESIDENT

International telecom spending slows down

THOUGH THE WORLD economy is forecast by many analysts to be about to recover from recent doldrums, still respondents to our survey of world-outside-the-U.S. telecommunications plant construction plans trimmed their estimates of a year ago by as much as 23%.

Extrapolating the returns from 98 telecommunications entities from around the world results in a 1982 spending amount of $52.536 billion, down from the $62.95 billion foreseen last year. Add in the U.S. Bell and Independent telcos' $24.624 billion and the world 1982 total is $77.16 billion (Table 1).

Recession

Difficult world economic conditions—recession, inflation, high interest rates, and an uncertain world balance of power being the major factors—led to stretching out, or canceling some PTT (national post, telephone and telegraph administrations) spending plans.

Other changes from last year's article (TELEPHONY, Feb. 23, 1981, p. 51): 1980 spending revised down from $52.779 billion to $43.153; and 1981, which was $60.141 billion, is now $46.259 billion. An early estimate of 1983 spending is $53.519 billion, but is based on reports of PTTs representing only 42.42% of non-U.S. telephones as of Dec. 31, 1981. Both that and the 1982 estimate are based on really too narrow a base for dependable extrapolation ('82 involved 44.67% of non-U.S. phones). The base narrowed, even for 1982, for several reasons: 1) because large PTTs like those in Japan and France continued to be cautious about advancing estimates for the upcoming year; 2) the result of opening up the telecom market in the United Kingdom led to sufficient uncertainty about the figures, even for 1981, that British Telecom did not venture an estimate beyond 1980; and 3) the unsettling world conditions listed above undoubtedly affected willingness to predict future expansion. At least for 1980 we had 71.94% of non-U.S. phones reporting, and for 1981 data, 63.45%.

Our extrapolation assumes construction expenditures in non-reporting nations were in the same proportion to telephones in place at the end of 1981 as those in reporting nations (see Table 2 on pp. 78, 79, 80, 81, 84 and 85). Another calculation assumption we made is that for a Dec. 31, 1981, non-U.S. telephone total. For this, we begin with Dec. 31, 1979, total of 296,601,000, reported in the World's Telephones, published by AT&T Long Lines, Overseas Administration, Morris

Continued on page 86

Table 1

Annual telecommunication construction spending ($ billions)

	World outside U.S.	Increase	United States	Increase	World Total	Increase
1975	23.837	—	11.947	—	35.784	—
1976	25.450	6.8%	12.525	4.8%	37.975	6.1%
1977	32.140	26.3	14.590	16.5	46.730	23.1
1978	33.138	3.1	17.422	19.4	50.560	8.2
1979	42.847	29.3	20.255	16.3	63.102	24.8
1980	43.153	0.7	22.049	8.9	65.202	3.3
1981	46.259E	7.2E	23.169E	5.1E	69.428E	6.5E
1982	52.536E	13.6E	24.624E	6.3E	77.160E	11.1E

E = Estimated

Table 2 World Telephone Totals

	Estimated population 12/31/81 of serving area	Total telephones 12/31/81 (est.)	Total telecom plant gross investment (in $ U.S. est.) (12/31/81)	Est. 1981 Domestic telecom service revenues (in $ U.S.)
World Zone 1				
Anguilla	6,519	350	n/a	n/a
Bahamas				
Bahamas Telecommunications Corp.	209,505	74,000	9,966,000	11,100,000
Grand Bahama Tel. Co. Ltd.	23,000	15,410	11,600,000	3,029,400
Barbados	249,500	66,627	66,202,500	9,907,500
Bermuda	55,240	48,140	39,472,000	11,825,000
British Virgin Islands	n/a	1,870	n/a	n/a
Canada				
Edmonton (Alta.) Tels.	522,000	516,000	455,710,000	136,370,000
Northern Telephone Ltd., New Liskeard, Ont.	134,200	76,104	57,701,675	17,971,776
Ontario Northland	5,000	2,334	40,660,000	23,250,000
Quebec-Telephone, Rimouski	533,024	283,537	330,310,000	42,324,494
Telebec Ltd., Montreal	300,000	169,075	175,619,127	60,577,181
Thunder Bay (Ont.) Tel. System	122,400	98,737	50,491,000	14,175,000
TransCanada Telephone System:				
Alberta Government Tels.	n/a	1,298,730[14]	n/a	n/a
Bell Canada	n/a	9,548,053	10,730,888,220	894,392,000
British Columbia Tel. Co.	2,716,301	1,977,000	2,549,925,000	471,120,000
Island Tel. Co., Ltd.	n/a	71,350[14]	n/a	24,453,000
Manitoba Tel. System	n/a	706,066	765,754,000	221,073,000
Maritime Tel. & Tel. Co.	n/a	498,239	589,591,932	207,302,000
New Brunswick Tel. Co.	n/a	391,878	494,571,678	176,513,303
Newfoundland Tel. Co.	n/a	201,835	289,328,687	98,295,416
Saskatchewan Tels.	n/a	623,275	834,805,000	267,600,000
Dominica	74,000	2,589	2,418,000	1,297,000
Dominican Republic	2,300,000	167,000	146,000,000	20,000
Jamaica	2,200,000	120,350	250,000,000	40,000,000
Montserrat	n/a	1,650	n/a	n/a
Puerto Rico Communications Authority	450,000	72,200	75,000,000	9,000,000
Puerto Rico Tel. Co.	3,152,640	679,458	977,253,000	242,948,000
St. Lucia	n/a	4,900	n/a	n/a
St. Vincent	n/a	3,700	n/a	n/a
Trinidad & Tobago	1,750,000	44,987	149,954,546	10,549,587
United States—Bell plus Independents	228,326,000	182,807,000	185,491,000,000	69,209,000,000
Virgin Islands Tel. Corp.	95,930	44,285	71,803,000	24,370,000
World Zone 2				
Ascension Island	n/a	240	n/a	n/a
Botswana	936,600	14,600	n/a	n/a
Egypt	44,000,000	527,800	203,476,000	48,491,000
Kenya	16,000,000	196,000	n/a	n/a
Seychelles	64,000	3,850	n/a	n/a
South Africa	24,743,218	3,138,400	2,563,113,000	n/a

(Arranged according to the International Telephone World Numbering Zone Plan, recommended by CCITT (International Telegraph and Telephone Consultative Committee, which is a part of ITU in Geneva, SW))

Est. 1981 international telecom service revenues (in $ U.S.)	Est. total employes 12/31/81	Actual 1980 construction expenditures (in $ U.S.)	Budgeted or estimated construction expenditures (in $ U.S.) 1981	1982	1983
n/a	n/a	n/a	n/a	n/a	n/a
29,000,000	1,369	16,619,000	9,966,000	23,220,400	n/a
730,600	82	1,869,000	1,767,000	1,648,000	1,094,000
5,365,000	650	8,222,200	8,000,000	10,000,000	8,300,000
6,600,000	460	4,978,000	4,535,000	14,300,000	5,247,000
n/a	n/a	n/a	n/a	n/a	n/a
n/a[1]	1,877	58,448,000	80,205,000	94,800,000	131,394,000
n/a[1]	314	7,004,000	6,792,000	7,611,000	6,735,000
750,000	165	3,000,000	4,100,000	4,800,000	6,800,000
76,263,579	2,187	36,447,000	38,480,000	39,458,000	42,738,000
n/a[1]	1,067	21,856,783	29,364,092	33,003,353	37,989,092
n/a	221	6,979,358	6,723,200	4,796,200	6,873,300
n/a	n/a	282,200,000[14]	324,530,000[14]	373,210,000[14]	384,400,000[14]
n/a	56,426	1,297,000,000	1,413,400,000	1,624,600,000	1,669,600,000
n/a[1]	14,400	318,900,000	371,436,000	n/a	n/a
n/a[1]	300	9,178,000	8,500,000	n/a	n/a
n/a	4,209	75,245,000	82,741,000	91,217,000	n/a
n/a	3,578	61,800,000	84,070,000	75,000,000	95,000,000
n/a[1]	2,776	40,421,000	52,500,000	65,000,000	65,000,000
n/a	1,431	32,800,000	35,000,000	38,500,000	42,600,000
n/a[1]	4,339	132,500,000	143,400,000	158,200,000	n/a
782,000	111	n/a	316,000	n/a	n/a
38,000,000	1,900	15,815,294	16,050,000	21,000,000	23,000,000
12,000,000	1,950	12,100,000	17,000,000	19,300,000	20,100,000
n/a	n/a	n/a	n/a	n/a	n/a
14,000,000	921	10,000,000	15,000,000	19,000,000	19,000,000
8,458,000	6,192	122,589,000	113,500,000	109,300,000	113,600,000
n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a
3,161,157	2,697	59,201,396	45,635,950	59,896,231	n/a
n/a[3]	1,072,200	22,049,000,000	23,169,000,000	24,624,000,000	n/a
1,653,000	449	5,514,000	7,667,000	8,420,000	9,950,000
n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a
56,098,000	57,267	146,482,000	203,476,000	285,713,000	357,141,000
n/a	5,899	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a
843,485,000[3]	n/a	368,182,000	502,300,000	648,209,000	702,086,000

Table 2 World Telephone Totals (continued)

	Estimated population 12/31/81 of serving area	Total telephones 12/31/81 (est.)	Total telecom plant gross investment (in $ U.S. est.) (12/31/81)	Est. 1981 Domestic telecom service revenues (in $ U.S.)
Zambia	5,600,000	60,500	126,000,000	31,104,000
Zimbabwe	7,600,000	224,452	111,592,109	57,241,278
World Zone 3 & 4				
Austria	7,559,000	3,200,000	2,935,927,000	n/a
Belgium	9,875,000	3,820,000	527,000,000	n/a
Cyprus	633,500	130,000	47,390,000	19,650,000
Denmark Telefontilsynet:				
Fyns	454,000	270,000	120,300,000	34,800,000
Jydsk	2,097,000	1,270,000	570,000	175,000
Ktas	2,315,000	1,780,000	555,400,000	213,500,000
Statstelefonen	n/a	142,300	328,905,000	134,723,000
Finland National Assoc. of Private Telephone Cos.	3,293,000	1,863,000	127,000,000	125,000,000
Posts & Telecommunications Administration	4,814,000	648,000	142,000,000	429,000,000
France	54,500,000	27,138,431	14,000,000,000	7,757,500,000
Germany, Federal Republic of	61,700,000	29,890,000	4,680,851,060	10,440,425,530
Greece	9,776,000	2,944,600	1,274,999,000	311,353,590
Guernsey-Channel Islands	56,000	38,700	18,800,000	6,500,000
Hungary	10,713,000	1,289,676	n/a	n/a
Iceland	231,500	114,000	215,000,000	28,700,000
Ireland	3,400,000	715,000	n/a	356,160,000
Italy SIP	57,296,000	20,453,000	13,170,000,000	3,920,000,000
Jersey-Channel Islands	76,080	55,400	31,750,000	12,141,000
Liechtenstein	26,000	21,437	2,600,000	n/a
Malta	346,000	90,000	52,300,000	4,870,000
Norway	4,105,000	2,000,000	457,729,250	781,106,300
Spain	37,900,000	12,469,474	15,869,672,100	1,823,029,000
Sweden	8,324,000	6,832,000	5,743,600,000	1,939,600,000
Switzerland	6,380,000	4,770,000	7,744,000,000[4]	n/a[3]
United Kingdom British Telecom	55,672,000[5]	28,632,000[6]	25,445,900,000	10,208,620,000
City of Kingston upon Hull Telephone Dept.	374,626	177,121	52,850,000	22,700,000
World Zone 5				
Argentina	27,862,771	2,224,199	n/a	499,342,830
Brazil Telebras	119,356,742	8,084,980	182,985,800	155,570,400
Chile	11,390,190	590,157[8]	1,349,600,000	188,200,000
Colombia Empresas Publicas de Medellin	2,140,749	236,000	n/a	20,760,000
Costa Rica	2,335,732	234,844	246,000,000	20,478,771
Guatemala	7,200,000	86,318	154,917,367	24,049,628

Est. 1981 international telecom service revenues (in $ U.S.)	Est. total employes 12/31/81	Actual 1980 construction expenditures (in $ U.S.)	Budgeted or estimated construction expenditures (in $ U.S.) 1981	1982	1983
19,865,000	4,000	18,436,400	16,000,000	29,000,000	50,000,000
12,227,332	2,796	11,424,053[2]	71,156,567	45,033,520	61,097,509
1,114,725,000[3]	56,332	483,800,000	570,300,000	576,200,000	582,700,000
1,278,000,000[3]	28,778	536,000,000	527,000,000	527,000,000	600,000,000
21,750,000	1,550	10,296,000	48,035,000	42,100,000	51,700,000
n/a	970	18,900,000	20,800,000	17,300,000	19,900,000
n/a	4,480	94,846,000	82,450,000	87,000,000	102,300,000
0	7,300	86,016,000	90,915,000	106,011,000	124,582,000
72,620,000	3,651	71,240,000	70,007,000	73,385,000	77,000,000
n/a	8,100	125,030,000	127,000,000	150,000,000	170,000,000
46,000,000	12,290	142,000,000	120,000,000	123,000,000	127,000,000
n/a	159,563	n/a	n/a	n/a	n/a
808,510,638	470,000	3,511,489,361	3,973,617,000	4,335,319,100	4,070,212,700
120,510,630	31,844	154,938,021	244,246,630	354,609,920	n/a
200,000	224	2,393,000	2,981,000	7,028,000	3,453,000
n/a	n/a	n/a	n/a	n/a	n/a
4,650,000	2,143	4,870,000	6,580,000	11,840,000	n/a
n/a[1]	17,000	198,840,000	352,660,000	n/a	n/a
n/a	73,000	2,098,000,000	1,808,000,000	2,174,000,000	2,275,000,000
2,298,000	309	2,683,000	7,039,000	7,962,000	3,337,000
n/a	n/a	2,300,000	2,600,000	2,700,000	3,600,000
8,720,000	1,500	5,100,000	9,310,000	10,540,000	n/a
128,303,900	22,300	476,330,825	443,144,600	460,157,200	460,157,200
272,406,000	60,713	1,476,718,000	1,400,207,270	1,317,427,370	1,317,427,370
n/a[1]	44,000	835,900,000	759,200,000	791,700,000	776,700,000
1,812,000,000	16,255	499,000,000	511,000,000	566,000,000	615,000,000
2,083,980,000	248,900	3,373,000,000[7]	n/a	n/a	n/a
n/a	674	7,680,000	9,740,000	13,020,000	15,480,000
44,433,962	45,761	884,298,200	824,752,000	389,201,414	n/a
27,415,400	99,965	835,500,000[13]	1,241,934,000	1,344,195,000	1,359,409,000
3,300,000	7,043	35,000,000	71,000,000	82,000,000	86,300,000
640,000	1,000	17,470,000	12,090,000	31,230,000	23,360,000
17,371,134	2,626	27,134,200	38,997,200	62,204,200	28,734,700
23,901,519	3,645	10,887,077	22,834,940	21,063,171	60,561,710

Table 2 continued on page 84

Table 2 World Telephone Totals (continued)

	Estimated population 12/31/81 of serving area	Total telephones 12/31/81 (est.)	Total telecom plant gross investment (in $ U.S. est.) (12/31/81)	Est. 1981 Domestic telecom service revenues (in $ U.S.)
Mexico				
Telefonos de Mexico	71,649,000	5,275,269	3,427,000,000	824,300,000
Panama	1,882,700	184,923	134,973,900	14,813,200
Venezuela	14,602,000	928,840	2,185,000,000	531,000,000
World Zone 6				
Australia	14,845,700	7,684,336	13,881,400,000	2,912,100,000
Brunei	194,600	21,900	54,149,000	4,600,000
Cocos (Keeling) Islands	230	150	n/a	n/a
Fiji	649,200	46,500	56,102,493	11,229,000
Guam	105,821	27,574	40,806,005	5,430,021
Malaysia	12,533,188	716,810	1,132,060,000	164,738,000
New Zealand	3,175,737	1,798,727[9]	548,732,722	458,243,565
Norfolk Island	1,800	826	235,000	58,500
Papua New Guinea	3,006,799	53,000	94,000,000	33,000,000
Philippines				
Philippine Long Distance Tel. Co.	13,931,576	672,962	544,569,725	95,547,719
Pitcairn Island	63	25	n/a	n/a
Singapore	2,434,000	775,113	727,003,000	106,795,000
Thailand	47,806,000[11]	537,000	431,700,000	129,600,000
World Zone 8 & 9				
Hong Kong	5,214,000	1,823,000	724,623,712	205,095,044
Israel	3,921,770	1,276,800[12]	2,510,000	290,000,000
Japan	117,890,000	58,332,000	39,320,000,000	17,041,000,000
Kuwait	1,510,000	231,643	334,000,000	66,030,000
Macau	330,000	15,680[12]	9,000,000	2,350,000
Saudi Arabia	n/a	788,576	n/a	n/a
Syrian Arab Republic	9,274,000	354,800	444,304,000	73,924,000
Taiwan	18,202,000	3,828,000	2,928,063,000	560,204,000
Turkey	46,000,000	2,140,285	175,000,000	212,000,000
United Arab Emirates	1,064,000	240,000	339,000,000	149,000,000

Table 2 Footnotes

[1]International telecommunication revenues in this instance—and others in this table—are grouped with the domestic revenues.
[2]Fiscal year ending June 30, 1981.
[3]Domestic revenues included with international.
[4]Not including land and buildings.
[5]As of March 31, 1982 (est.).
[6]Excludes from here on the City of Hull which provides its own local service.
[7]Fiscal year 4/1/80 to 3/31/81.
[8]Of this total, 571,115 are Chiltelco and 19,042 are for other telcos.

Est. 1981 international telecom service revenues (In $ U.S.)	Est. total employes 12/31/81	Actual 1980 construction expenditures (In $ U.S.)	Budgeted or estimated construction expenditures (In $ U.S.) 1981	1982	1983
379,200,000	27,568	361,530,000	552,890,000	947,930,000	1,241,060,000
18,874,900	3,255	14,416,500	26,930,000	30,091,000	33,274,700
129,000,000	1,800	121,830,000	204,830,000	463,410,000	547,830,000
85,800,000	89,992	1,361,500,000	1,477,800,000	1,548,600,000	1,603,000,000
3,000,000	600	10,088,000	9,702,000	n/a	n/a
n/a	4	n/a	n/a	n/a	n/a
3,733,500	1,450	4,364,495	5,941,680	6,385,140	n/a
2,613,823	236	14,958,177	2,264,789	8,900,000	8,100,000
74,229,000	35,423	259,675,000	201,462,000	314,707,000	n/a
43,187,121	25,407	72,321,600	103,475,520	138,709,120	161,240,080
97,000	7	14,000	28,500	40,500	n/a
4,000,000	2,889	15,731,050	21,001,220	28,784,400	36,946,500
55,769,667	12,000	162,280,000	227,648,000[10]	n/a	n/a
n/a	2	n/a	n/a	n/a	n/a
201,003,000	10,464	107,700,000	142,107,000	218,820,000	256,460,000
n/a	11,300	46,004,000	38,043,000	137,770,000	338,607,000
139,841,594	11,943	82,759,000	151,101,000	218,867,000	186,330,000
150,000,000	8,230	170,000,000	167,000,000	n/a	n/a
720,000,000	n/a	7,865,000,000[7]	7,695,000,000	n/a	n/a
109,501,000	7,500	108,465,000	105,700,000	n/a	n/a
4,000,000	275	n/a	n/a	15,000,000	22,500,000
n/a	14,189	n/a	n/a	n/a	n/a
7,089,000	11,978	68,098,000	70,127,000	100,397,000	112,152,000
149,186,000	29,510	652,986,655	758,526,000	866,651,000	909,109,000
15,000,000	n/a	127,333,333	175,000,000	230,000,000	323,000,000
96,000,000	4,375	76,000,000	102,000,000	103,000,000	108,000,000

Table 2 Footnotes

[9]New Zealand statistics are as of 3/31/81 and parallel fiscal years.
[10]With acquisition of Republic Tel. Co. 2/14/81 this amount would be $113,227,000 higher.
[11]Thailand data as of 9/30/80.
[12]Telephones data submitted for last year's survey used, plus estimated 6.4% growth.
[13]TELEPHONY estimate (same amount as Telebras estimated for 1980 in last year's survey).
[14]TELEPHONY estimate.

Continued from page 74

Plains, N.J., U.S., June 1981. We estimated 6.8% growth in their total for 1980, and a bit slower growth, 6.4%, in 1981, resulting in an estimated 337,043,000 phones at year-end 1981. Combine this amount with the U.S. estimated total and we see the world has access to about 520,210,000 phones.

The top 10 construction spenders outside the U.S. reporting to TELEPHONY for 1982 are (expressed in billions of U.S. dollars): West Germany, 4.335; Italy (SIP), 2.174; Telebras (Brazil), 1.844; Bell Canada, 1.625; Australia, 1.549; Spain, 1.317; Telefonos de Mexico, 0.948; Taiwan, 0.867; Sweden, 0.792; and South Africa, 0.648. Others we either did not receive 1982 spending estimates for or from which we did not hear, but which from past reports we could expect to be among the leaders, include (amounts in billions of U.S. dollars): Japan, 7.7 (1981); France 5.6 (1980); United Kingdom, 3.4 (1980); Republic of Korea, 1.702 (1981); and the Netherlands, 0.4965 (1979).

News or articles appearing at various times in the past year have included plans not reported for this survey; among them: an article on India's expectation of adding 1.73 million phones in its sixth 5-year plan (TELEPHONY, Jan. 25, p. 73); news of the PTT of Surinam placing a $14.5 million order; and The Congo ordering $21.2 million worth of telephone, radio and television equipment. Other spending plans from non-reporting countries appear on occasion in exhibition publicity; for example, pre-show information on CommunicAsia 81 carried the plans of non-reporting Indonesia, as well as countries such as Malaysia, Singapore, the Philippines and Thailand, which did report (TELEPHONY, October 19, 1981, p. 78). Again, the show report can also be a rich lode of market perspective, as was the CommunicAsia followup (TELEPHONY, Jan. 25, p. 64). It reported Singapore PTT thinking, Philippine and Brunei forward looks, plus exhibitor highlights, and concluded with a sobering thought: "There will be many changes in the telecommunications scene by then [January 1984, occasion of the next CommunicAsia], and although Western industry appears to be holding ground against its Japanese rivals in these markets, as one senior official from a local administration commented, "what will happen when Casio or Sanyo start mass-producing digital PABXs [private automatic branch exchanges] in the way they now produce electronic games and calculators?"

Two other prime examples of the considerable amount of market information available in reports of meetings are those on the International Switching Symposium in Montreal in September 1981 and Sviaz in Moscow, also in September—and both conventions covered in the October 19, 1981, TELEPHONY in detail (pp. 64 and 72, respectively). If one could not attend, he or she could still derive a lot of benefit reading what went on and what was shown.

In Table 3 we see the specifics of what is AT&T's [American Telephone & Telegraph Co., New York] fastest growing business segment, and what in past spending surveys has been cited as one measure of how much the equipment installed with the construction dollars is used. One of the ways, incidentally, that Bell has handled this explosive growth is with four AT&T Long Lines international operating centers of the International Service Position System (TELEPHONY, July 20, 1981, p. 24).

One more perspective on the international market: as more and more countries open up to ownership and interconnection of private systems and equipment, the experience of the U.S., U.K., Canada and the rest in this emerging sector will no doubt prove helpful. Recently, for example, British Telecom chairman Sir George Jefferson stated: "If British suppliers are to maintain their position in our market, they will in future need to demonstrate that they can offer products that are internationally competitive in performance, styling, technology and price, since in the new competitive environment the products w[illegible] market will eventually be chosen from a worldwide range." The customer, he emphasized, is our first priority. And that would seem to be a top priority around the world, in view of the spending plans discussed here—which, though they were trimmed, as earlier pointed out, still rose 29.3% in 1979, and at least moderated at that fairly high level. □

Table 3

Overseas Telephone Service*

	Two way messages			Two way messages	
	Quantity	Growth %		Quantity	Growth %
1927	11,753	—	1953	1,440,317	5.6
1928	22,665	92.8%	1954	1,529,152	6.2
1929	30,323	33.8	1955	1,742,368	13.9
1930	33,821	8.2	1956	2,024,117	16.2
1931	33,253	1.3	1957	2,421,332	19.6
1932	27,971	(15.9)	1958	2,687,836	11.0
1933	30,195	8.0	1959	3,088,645	14.9
1934	26,665	(11.7)	1960	3,713,183	20.2
1935	28,059	5.2	1961	4,365,020	17.6
1936	48,429	72.6	1962	4,914,262	12.6
1937	75,010	54.9	1963	5,290,460	7.7
1938	75,058	0.1	1964	6,382,127	20.6
1939	76,189	1.5	1965	8,108,030	27.0
1940	73,429	(3.6)	1966	9,931,918	22.5
1941	116,680	58.9	1967	12,332,231	24.2
1942	135,196	15.9	1968	15,166,091	23.0
1943	153,799	13.8	1969	20,800,303	37.1
1944	173,799	12.8	1970	26,305,694	26.5
1945	360,341	107.8	1971	32,245,147	22.6
1946	631,665	75.3	1972	40,225,532	24.7
1947	664,273	5.2	1973	47,478,563	18.0
1948	797,531	20.1	1974	59,878,146	22.8
1949	852,865	6.9	1975	71,662,752	19.7
1950	1,000,184	17.3	1976	87,140,523	21.6
1951	1,263,362	26.3	1977	109,599,014	25.8
1952	1,363,775	7.9	1978	149,521,467	36.5
			1979	181,521,678	21.4
			1980	241,000,000	32.7
			1981	287,000,000	19.1

*Overseas in this context is defined as all calls to and from the 48 contiguous United States to all points outside these states, except to Canada and Mexico.

Source: AT&T Long Lines-Overseas Dept./Economic Research (Morris Plains, N.J.)

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Undersea cable systems plunge into the waters of new technology

Here's how undersea cable systems are moving with the flow of technological developments, in order to maintain a competitive position in the global telecommunications network

B.M. DAWIDZIUK

LAST MAY, the British Telecom cableship *Monarch* laid the U.K. end of a new transatlantic cable, TAT-7, and the actual construction of yet another major intercontinental communications artery quietly began. The capacity of this new transatlantic cable is 4200 basic voice grade circuits capable of further expansion by the use of the circuit multiplication equipment of Time assignment speech interpolation or similar type.

Measured in terms of the design capacity of the contemporary International Telecommunications Satellite Organization ((INTELSAT) satellites, or INTELSAT-V, this new cable appears to be relatively small. Yet, recognizing that the cable systems provide mainly point-to-point circuit facilities, and in practice the configured capacity of any operational satellite is well below its design capacity, the importance of the TAT-7 cable as one of the key elements of the North Atlantic communication network becomes apparent. Clearly, superficial analysis of loosely related facts can easily lead to misleading opinions, or conclusions. This article will provide basic facts about undersea systems achievements, their role and their future.

Undersea cable systems are well established as the principal element of the global network. This is evident when statistics are examined in detail. Table 1 summarizes the status of the global cable network at the end of 1981.

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Cover photo by Cable & Wireless

Cable is carefully loaded into the Cable Venture, *a cable ship.*

The facts given in Table 1 are impressive. They cover cumulative developments since 1950, the year the first repeatered cables were introduced in service over short distances in the North Sea and the Caribbean. This is reflected in the relatively low equivalent average system capacity of 700 circuits, because the early cable systems had 60 or 120 circuit capacity. This was a large capacity at the time of installation.

Of course, allowances were made for systems that have been withdrawn from the network, such as the TAT-1 cable phased out of operation in November 1978 after 22 years of successful service.

But Table 1 gives little information about the recent developments in the global cable network. Taking as an example a period of the last 5 years, similar statistics show a more interesting picture (Table 2).

The $1.2 billion invested in undersea cable systems during the last 5 years represents approximately 31% of the cumulative total capital cost of the cable network to date. The network itself, when measured in terms of circuit miles, has increased by 42%. The average capacity of installed systems has been significantly increased. This reflects the installation of modern, high capacity systems.

Considering that in the same period, INTELSAT consolidated its network by the widespread deployment of the INTELSAT IVA satellites and the introduction, in 1981, of the new generation of INTELSAT V satellites, the development of the global cable network is remarkable. These numbers do not include major transoceanic systems currently under construction, such as TAT-7.

Currently, there are approximately 16 cable systems under construction for several national telecom

Table 1

Status of global cable network (End of 1981)

Number of operational cable links	214
Total cable route mileage	140,500 nm
Total cable network size	98.6 m circuits/nm
Equivalent average system capacity	700 circuits
Cumulative investment in cable systems	$2.9 billion

administrations (PTTs) and international service carriers. There are a variety of systems. Some are major, multisegment transoceanic cables. Others are short, or medium length inter- or intraregion systems. The underlying desire to ensure operational diversity and network security is reflected in the current construction of three transoceanic systems. These will significantly contribute to the cable network capacity, and the resultant investment in this technology.

Details of the construction program for such transoceanic systems are given in Table 3. The most recent project—the ANZCAN system—warrants special mention, because it represents an important development in the Pacific Ocean. The main link is between Australia and Canada with the intermediate terminal points in Norfolk Island, Fiji and Hawaii. As a part of the ANZCAN system there is a branch cable connecting New Zealand with Norfolk Island. Some segments will be ready for service during 1983, but the complete system will be operational in 1984.

The combined route of the three transoceanic systems is 15,225 nautical miles. They will add 31.1 million circuit miles to the existing cable network capacity, an increase of about 32% above the network position at the end of 1981.

This is not all. There are 13 regional systems under construction covering almost every major maritime area (Table 4).

Another $550 million has been committed by the co-owners of these facilities to cover the systems described in Table 4. When these current projects are completed by August of 1984, the total global cable network is likely to consist of 235 separate cable links, offering 144.6 million circuit miles. The cumulative investment would reach $4.25 billion.

This is not the end of the story because up to this point only firm projects have been included in the overall network statistics. Many new systems are in various stages of planning. Out of necessity, information is only tentative, but it clearly indicates the important role that undersea systems will play in the make-up and traffic distribution of the global communications network in the late 1980s.

The recent expansion of the cable network in Southeast Asia has strengthened the position of Singapore as the major communication center of the area. Plans for new cable systems radiating from Singapore are expected to be finalized in the near future. The main aim would be to interconnect Southeast Asia with the Middle East and Mediterranean, and then with Europe. Such a project is now under evaluation regarding the final routing and system capacity for each individual cable segment. It is likely that the route will connect Singapore with Indonesia, Sri Lanka, Djibouti, Saudi Arabia, Egypt, Italy and France. It will be truly transoceanic in magnitude. Another cable linking Singapore with the Far East also is under study and the final details are expected to be known in the near future.

Undersea cable systems are now being introduced between the Gulf states. Planning is in progress to connect the Indian subcontinent with the Gulf and East Africa.

New cables are being actively planned for the Caribbean region. The Federal Communications Commission (FCC), is due to commence the evaluation of these plans in the near future. This FCC activity will follow the completion of the planning process for the Pacific region. Last May, the FCC published the notice of proposed rulemaking, which authorizes the investment by the United States Independent Service Carriers in the ANZCAN system. The proposed Pacific plan also includes construction of the continental U.S. to Hawaii No. 4 cable, and a transpacific link from Hawaii to Japan. The target date for this next transpacific cable is 1988.

The North Atlantic facilities planning process, established as part of the activity leading to the final approval by the FCC of the TAT-7 cable in 1979, is addressing the long term future of the transatlantic communications. Current plans assume construction of the next cable—TAT-8—in 1988. It will be the first transoceanic application of the new generation of digital submarine systems.

During the late 1970s there was rapid development of undersea system technology. Systems with bandwidths of 25, 28, 36 and 45 MHz (megahertz) were progressively in-

Continued on page 28

Table 2

Growth of global cable network during the last five years (1977-1981)

Number of cable links installed	48
Total added cable route mileage	26,640
Total added network capacity	41.1m circuit/nm
Equivalent average system capacity of added cables	1540 circuits
Associated investment in these cable systems	$1.2 billion

troduced into service in 1976 and 1977 by various administrations. These systems offer a basic capacity between 2500 and 5500 voice grade circuits.

Current system designs offer a whole range of circuit capacities, covering low, medium and high traffic density routes. They range between 480 and 5520 circuits depending upon the system bandwidth and the multiplex arrangements. The majority are capable of crossing transatlantic distances, including the highest capacity 45 MHz system.

In the late 1970s advanced laboratory research and development work addressed the technical feasibility of even larger bandwidth systems, capable of providing 10,000 to 15,000 circuit capacity. Outline designs are available for undersea analog systems with about 15,000 circuit capacity working at 140 MHz line frequency. Using conventional coaxial cable, the repeater spacing becomes very close—about 3.4 km. Undoubtedly, such systems would be economical for high traffic density routes.

However, 140 MHz analog systems are unlikely to be implemented, since the recent trend is towards digital capability. There are many reasons for this, some valid, others based upon expectations of potential economic benefits—if a number of key assumptions prove to be achievable.

There are four undisputed facts. One, switching systems are changing to digital operation. Two, local networks in many countries have been using pulse code modulation systems for several years. Three, a number of countries with mature telecommunications networks already have long distance digital network overlays. Four, INTELSAT is introducing time-division multiplex access (TDMA) as a part of the operational requirement for INTELSAT-V satellites.

The demand for digital transmission capability has also affected the direction of undersea cable systems research and development programs. Extensive studies have shown that a direct application of digital transmission on conventional coaxial undersea cable is not economically feasible. An alternative approach, capable of economically providing a four-wire working arrangement, is essential. Here, optical fibers offer exciting possibilities provided the necessary and traditionally accepted high design reliability of all new system elements can be achieved when it is needed and without undue economic penalties.

Sufficient design studies supported by laboratory evaluations have been done on optical undersea cable systems to confirm the feasibility of this new technology. The question is not if such systems are possible, but when can the necessary reliable engineering work be completed to provide the required confidence for the use of this new technology.

It takes time to translate early laboratory experiments of a new technology into mature engineering applications. This is especially so in the field of highly reliable and durable products currently in use for the underseas cable network of the world.

There appears to be a consensus of opinion between the various countries having undersea cable system design capability that early experimental systems are likely to appear around 1984 or 1985. The first commercial applications on a regional basis are expected to follow about 2 years later. Early candidates for the construction of operational undersea optical fiber systems are several routes in Europe where further cable capacity will be required on major trunk routes in the

Continued on page 30

Table 3

Transoceanic cable systems under construction (June of 1982)

Route	Service date	Capacity	Route length nm
Atlantis South (Brazil-Senegal)	1982	1380	1780
Atlantis North (Senegal-Portugal)	1982	2580	1620
TAT-7 (U.S.A.-U.K.)	1983	4200	3290
ANZCAN (Main link: Australia-Canada)	1984	1380	7740
ANZCAN (branch: New Zealand-Norfolk Island)	1983	480	735

Table 4

Regional cable systems under construction (June of 1982)

Region	Number of systems	Combined route length
North Sea/European Atlantic coast	5	1277
Mediterranean	3	1317
South east Asia	3	1458
The Gulf	1	474
Caribbean	1	1220
Total	13	5746

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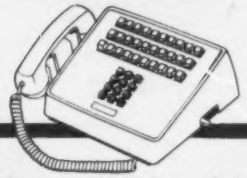

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The first transoceanic optical fiber system is planned for 1988. This probably will be the TAT-8 cable linking the U.S. and Europe (see article p. 32). Various configurations are still under study, but this link could provide basic system capacity in the range of 8000 to 12,000 circuits. A significant increase in this capacity can be readily achieved by the use of digital speech interpolation (DSI). The final deciding factor of system capacity will be traffic requirements, rather than technology limitations.

Soon after the construction of the TAT-8 system, an optical underseas cable is expected to be installed across the Pacific following and consistent with the proposed FCC rulemaking on Pacific facilities.

This new undersea cable technology is likely to offer several advantages. Besides being a natural digital transmission medium, it will offer:

- large capacity systems limited only by the specific route traffic requirements;
- modular capacity using standard electronic modules, and variable numbers of fiber pairs in one cable structure for a given route;
- underwater branching units, which could allow two or three separate landing points at both ends of the system, if specifically desired by the co-owners;
- ease of deploying DSI to increase significantly the total utilization of the basic system bandwidth; and
- attractive system economics if the full potential for cost reduction due to significantly increased repeater spacing for high capacity systems is achieved in practice—the basic cost of high quality fiber will be one of the key economic parameters deciding the final level of system economics.

In order to achieve the potential economic benefits of this new technology, undersea optical cables will use monomode fibers. The first systems are likely to operate at 1.3 micron wavelength. At this wavelength repeater spacing of some 30 km is practical for operation at 280 Mbps (megabits per second) per pair of fibers enclosed in a cable structure which is less than 1 in. in diameter. In the case of a 280 Mbps equivalent analog system (45 MHz system), repeaters have to be inserted every 5.4 km using 1.5 in. cable. This is just one example of the potential benefits offered by the introduction of fiber optics for undersea telecommunications.

As with the case of terrestrial systems, the transition to digital and to fiber optics will be gradual, and is likely to take the best part of this decade.

Existing designs of analog systems are being, and will be, ordered for some time to come. The ANZCAN project is a good example. The plans for the Indian Ocean cable are also based upon analog technology. Digital systems are perfect for digital traffic. Otherwise, conversion from analog (A) to digital (D), or from D to A is necessary.

Despite the extensive volume of published material, in reality there are currently few countries that have extensive digital traffic. Many advanced countries are still finding difficulties in direct TDMA access to the INTELSAT-V system, because D to A conversion is necessary for traffic extension from the satellite earth station to the main traffic centers.

The world is gradually moving from A to D in all forms of telecommunication network operation and hardware. Undersea cable technology is also moving in that direction, not only to keep abreast of the technological developments but to maintain its competitive position as one of the principal elements of the global telecommunications network of the future.

As the status of the current global cable network programs demonstrate, cable technology has been accepted as an essential element in the drive for a highly diversified network structure.

Modern automation and annually increasing volumes of traffic demand total network reliability, excellent circuit quality and low costs. These key attributes are already being offered by the existing analog undersea cable systems. In the future, when all potential economic and configuration benefits of the optical fiber systems will be realized, the basic attractiveness of cable systems will be further increased. Thus, the complementary satellite technology might find itself under extreme competitive pressure from the cable alternative.

In these circumstances, satellites are likely to be used more for the broadcast mode for which they are ideally suited, with cable systems providing the heavy trunk routes of the global communication network of the 1990s. □

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Telecom marketing during the recession

Tight money and high interest rates—every businessman knows their effects. But telecommunications companies also must realize how the state of the economy can affect their marketing strategies

MARTIN W. FLETCHER

A COMPARATIVE REVIEW of the effect of the last major recession of 1974-75 on the U.S. telecommunications industry by Dataquest, Inc., shows that usage-related services are concurrent or leading economic indicators, while non-usage-related services lag behind the economy by as much as 1 year.

In the present environment, large PBXs (private branch exchanges), high-speed modems and small data multiplexers should show growth even under the conditions of a prolonged recession. A turnaround in the U.S. economy should be favorable to the markets for small PBXs, electronic featured key systems and large data multiplexers.

The following available statistics and estimates provide a pattern for comparing the effects of the recession on the telecommunications industry for: total telco revenues; long distance revenues and calls; and local revenues and calls.

The annual growth in total U.S. telco revenues over the period from 1971 through 1978 is shown in Table 1, and is compared with the annual growth of real gross national product (GNP) for the same years. The table highlights the years 1974 and 1975, which some analysts have classified as depression years for the U.S. economy. Total telecom revenues continued to grow, though there was a minor decline in the rate of growth. By comparison, U.S. factory shipments of passenger automobiles, for example, declined 24% in 1974, and a further 8.4% in 1975.

For 1981, total U.S. telco revenues for communications services were at the $64 billion level, approximately 12% above the previous year's mark.

The annual growth of U.S. long distance (interstate and intrastate toll) revenues for the period from 1971 through 1978 is shown in Table 2. The growth in calls provides unit growth, and allows comparison without the factors in revenues that involve tariff increases. The numbers for calls shown in Table 2 include international calls, but exclude non-revenue producing calls such as directory information. The figures show that long distance calling, which is charged according to usage in North America as elsewhere, tends to be a concurrent—or even slightly leading—economic indicator.

For 1981, U.S. long distance revenues are estimated to be at the $34 billion level, with growth of more than $4 billion over the previous year. American Telephone & Telegraph Co. (AT&T) received $30.2 billion in long distance revenues in 1981.

AT&T's increase in long distance revenues of just below $4 billion was approximately five times the combined gross revenues, not increases, of its competitors in intercity services. Total long distance calls are estimated to be approximately 20.5 billion in 1981.

The percentage growth in U.S. local revenues, and even more specifically local calls, show that this sector responds to downturns in the economy with a 6-month to 1-year lag (Table 3). In the United States the majority of local calls are still made on a flat rate basis, although this is slowly changing. Thus, negligible savings are incurred by reducing local calls. However, savings can be made by reducing installed tariffed equipment. Evidence for this conclusion is seen in Table 4, which shows that a reduction occurred in the rate of growth of telephones in service, but only when the recession was in its second year.

The implications of these data relative to revenues, calls and installations are as follows:

- Telephone usage is a concurrent,

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Martin W. Fletcher is Vice President of Dataquest, Inc., Cupertino, Calif. This article is adapted with permission from a Dataquest Research Newsletter, copyright June 1982.

Table 1

Total telco revenues (United States)

Year	Growth over previous year: Revenues	Real GNP
1971	10.1%	3.2%
1972	13.4%	6.1%
1973	14.9%	5.5%
1974	11.5%	-1.4%
1975	10.5%	-1.3%
1976	14.1%	5.9%
1977	11.3%	5.3%
1978	12.6%	4.4%

Revenues CAGR 1970-78: 12.3%

Sources: Federal Communications Commission, Federal Reserve Board

and possibly slightly leading, indicator of general economic activity. Specifically, usage appears to lead when the economy is coming out of a recession.

• Telephone subscriber equipment commitments follow general economic activity to the extent that unless a recession is 1 year or longer in duration, the annualized effects are insignificant.

Nevertheless, the 1974-75 recession did cause significant downturns in the business of the equipment manufacturers. Manufacturers at that time mainly supplied telcos. The telcos reduced their inventory levels so that the recession's impact for them was minimal. However, this reduction in inventories resulted in significantly less sales for manufacturers, whose shipments grew only moderately even as the recession ended and telcos gradually rebuilt their inventories to pre-recession levels.

The current recession's effects in the first 4 months of 1982 so far have not had as significant an impact on equipment manufacturers as they did in 1974-75. More than 50% of the sales of PBXs in the U.S. market now reach the end users either through interconnect distributors, or directly from manufacturers. The interconnect distributors normally do not carry inventories, and the direct sale manufacturers are their own beneficiaries of reductions in inventories. Thus the recessionary effect in 1982 is far less pronounced for equipment manufacturers than it was in 1974-75. A recent survey of representative manufacturers, sales representatives, wholesale distributors and interconnect distributors sought to assess the effects on various sectors of the telecom and datacom terminal equipment markets for the first 4 months of 1982.

Shipments in PBX lines are estimated to be 7% to 10% ahead of shipments in the same period of 1981. Shipments of systems with fewer than 100 lines are estimated to be 5% to 8% above 1981's figures. Three manufacturers—American Telecom, Mitel and Siemens, all competitively priced below other market contenders—registered growth significantly above the average. None of these companies had reduced its factory prices at the time of the survey, and all three sell the majority of their systems in the United States through wholesale distributors.

The market for PBXs of 100 to 400 lines is estimated to have grown in the first 4 months of 1982 at 4% to 7% above its 1981 rate. This is the sector with the most significant competitors, and also is the sector in which most penetration has already been made by interconnect distributors and by replacement of electromechanical equipment by electronic equipment.

PBXs of more than 400 lines are estimated to be showing by far the best growth over the 1981 rate. The growth is in a range from 15% to 20%. This line-size sector is benefiting from centrex replacement, and many large, multimillion dollar replacement orders already have been placed in 1982. Northern Telecom appears to be benefiting significantly from this growth, with NEC and Rolm also enjoying growth. Large PBXs have always been negotiable in price, and the present economy is exerting even more pressure on the profit margins of higher-cost manufacturers.

Approximately 515,000 key telephone systems (KTSs) were shipped in 1981 for a total OEM (original equipment manufacturer) value of $520 million, and an end user value (on an "if-sold" basis) of $2.1 billion. It is estimated that 110,000 featured systems were shipped to the U.S. market in 1981 for an OEM value of $220 million. These systems have such features as voice announce, line privacy, paging access and toll restriction. Some fully featured systems also have least-cost routing and message detail recording. Growth in this market is estimated to be 15% to 25% above 1981 for the first 4 months of 1982. TIE/communica-

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Table 2

Telco long distance revenues and calls (United States)

Year	Growth over previous year: Revenues	Calls
1971	11.1%	5.3%
1972	13.2%	10.7%
1973	18.5%	8.4%
1974	11.0%	7.1%
1975	11.5%	8.1%
1976	16.2%	7.6%
1977	12.9%	10.9%
1978	15.1%	12.7%

Revenues CAGR 1970-78: 13.7%
Calls CAGR 1970-78: 8.9%

Sources: Federal Communications Commission
American Telephone & Telegraph Co.
Dataquest Inc. estimates

Table 3

Telco local revenues and calls (United States)

Year	Growth over previous year: Revenues	Calls
1971	9.4%	5.5%
1972	12.8%	5.8%
1973	12.7%	5.6%
1974	12.1%	5.5%
1975	9.5%	2.7%
1976	12.8%	5.1%
1977	9.6%	6.5%
1978	9.8%	5.7%

Revenues CAGR 1970-78: 11.0%
Calls CAGR 1970-78: 5.3%

Sources: Federal Communications Commission
Dataquest Inc. estimates

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tions exceeded this growth.

Almost 80% of the KTSs shipped in 1981 were non-featured, of the 1A1 and 1A2 types. Of these 405,000 systems, more than 50% were installed behind PBXs. The total 1981 U.S. OEM market value for all non-featured systems was $320 million. Sales of these systems are flat to slightly negative compared with 1981 figures.

The 1982 U.S. market for datacom equipment continues to benefit from the cost-saving features offered by high-speed modems and data multiplexers.

The low-speed modem market remains essentially flat. It would have shown a significant decline, except for the growth of the personal computer market.

The high-speed modem market in the first 4 months of 1982 is estimated to be 25% to 35% higher than the 1981 market. Codex and Paradyne both had growth above this average. This sector of the datacom market includes data multiplexers concentrating eight lines or less. Growth so far in this market in 1982 is 30% to 40% above 1981, with Micom Systems still holding the lion's share of the market.

The market for large multiplexers used with larger mainframes and extensive small computer networks is estimated to be growing at 15% to 20% over last year's figures. Codex and Timeplex have had above average growth.

Telecommunications equipment and services markets exhibit significant recession resistance. However, a prolonged and somewhat deeper recession would reduce growth by 10% to 15% in most markets. Nevertheless, the large PBX, high-speed modem, and small data multiplexer sectors of these markets can be expected to retain some growth even under this pessimistic scenario. No sector, however, is likely to grow in a depression. In the event of economic improvement in the U.S. economy in the second half of calendar year 1982, small PBXs, electronic featured key systems and large data multiplexers would be the markets which would demonstrate new growth the earliest. □

Table 4
Telephones in service
(United States)

Year	Growth over previous year
1971	4.1%
1972	5.2%
1973	5.0%
1974	4.2%
1975	3.5%
1976	4.2%
1977	4.4%
1978	4.3%
CAGR: 4.4%	

Source: Federal Communications Commission

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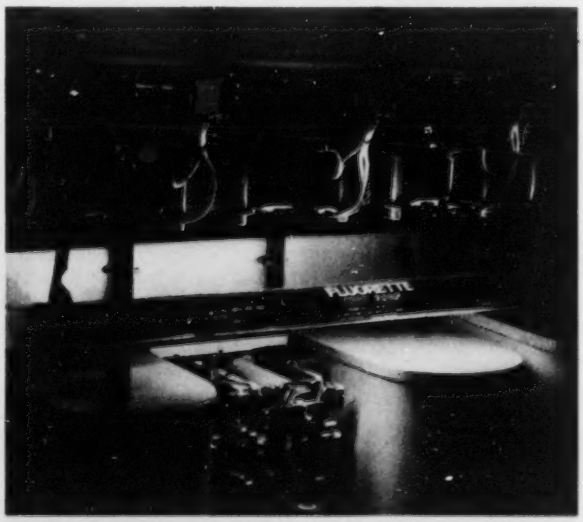

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Evaluating telecom nets requires updated indicators

CHARLES BORSOS

THE STATE OF development of the telephone network and the spread of the telephone services in individual countries have usually been characterized by three indicators: the density of telephone sets; the percentage level of automation; and the proportion of main sets and extension telephone sets.

These indicators showed to what extent the telephone network was in accordance with the general level of the economy. The most significant of the three was the degree of density of telephone sets. Previously, at the low or the medium level of network development, these indicators could be used to perform economic calculations and to elaborate development projects. However they are not applicable anymore. The development of telephone networks is progressing in the Third World, where the production, structure and the composition of the families differ significantly from the American and European models.

Based on the following information, one must conclude that the use of new indicators is necessary.

An evaluation of indicators presently in use provides a basis to form new indicators.

Density

The density of telephone sets is the number of sets (main and extension) per 100 inhabitants of a country, city or region. The number of sets is an unweighted total of the main sets of public authorities, their main lines and private branch exchange (PBX) extensions, main and extension residential sets and public sets. (For the purpose of this article, the term sets of public authorities means all sets used for administrative, business and professional purposes.)

The word unweighted is important here because the density of telephone sets includes the residential extensions despite the fact that the extensions have no significant influence on the original calls. Their use only increases convenience and speeds up the reception of incoming calls. Due to this fact the residential extension sets should not be taken into consideration when counting residential sets. But the extension sets of the public authorities do contribute to the number of originated calls and, therefore, they should be taken into account.

The data shown in Table 1 indicate that it is expedient to treat the main and extension sets of the public authorities jointly. The proportion of the main and extension sets of the public authorities is independent of the country's economic development; instead, it depends on the administrative methods adopted.

The density of telephone sets does not reflect the economic structure of countries or their social conditions. Comparing the density of telephone sets in Switzerland and Sweden (Table 1) which are countries with similar economic levels, it can be seen that Switzerland has 31.6 public authority sets per 100 persons, and Sweden has 22.2 sets per 100 persons. Thus, Switzerland has 42.3% more public authority sets, per 100 persons than Sweden. This difference cannot be explained by underdevelopment, but is explained by the different economic structure of the two countries considered; that is, by the different needs of the dominant economic branches for telecommunications. Commerce and servicing branches need more telecommunications than, for example, agriculture if telecom-

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Charles Borsos is a Public Engineer and Consultant, and former Directional Counsellor of the Hungarian Post and Telephone Administration (PTT). This article is translated from a paper which was presented to the International Congress on Technology and Technology Exchange, Pittsburgh, Pa., May 3-6, 1982.

Table 1

Distribution of public authority and residential telephone sets

Jan. 1, 1978

	Density of telephone sets			Public authority sets			Residential sets		
	nationwide	public authority	resident	main sets	extension sets	extensions per main sets	main sets %	extensions sets %	extensions per main sets
Bulgaria	10.7	5.9	4.8	45	55	1.22	100	0	0
Canada	63.2	21.2	42.0	54	46	0.87	66	34	0.53
Czechoslovakia	19.0	12.6	6.4	29	71	2.47	100	0	0
East Germany	17.1	13.1	4.0	26	74	2.87	100	0	0
Greece	25.1	7.9	17.2	43	57	1.35	100	0	0
Hungary	10.3	7.2	3.1	25	75	3.06	100	0	0
South Africa	9.8	5.6	4.2	26	74	2.86	100	0	0
Spain	26.3	15.5	12.8	55	45	0.79	64	36	0.57
Sweden	71.7	22.2	49.5	21	79	3.87	93	7	0.08
Switzerland	65.9	31.6	34.3	23	77	3.35	100	0	0
England	41.5	16.9	24.6	39	61	1.57	84	16	0.19

munications costs needed to obtain one unit of money are compared.

When considering the density of telephone sets, the density of main residential sets does not indicate the degree to which the demands of the population are satisfied because satisfaction depends essentially on the number of households per 100 inhabitants and on the number of households served by each set. If, for example, the average number of inhabitants per residence is 2.5 in a country, then the saturation value for residences is 40 per 100 inhabitants as a first approximation. If the average number of family members is five persons, then the saturation is achieved at a density of 20 per 100 inhabitants.

Summing up, it can be concluded that the density of telephone sets as an indicator is easy to calculate, but this measure does not show whether the actual number of the sets is sufficient under the circumstances. This measure is not suitable for comparison and represents a trap that may mislead technical and economic planners.

Percentage level of automation

The measure of the relative level of automation indicates the percentage of the main telephone sets served by automatic exchange within a country or its territorial units. This indicator is at least as misleading as the indicator of the density of telephone sets.

Based on this proportional measure, higher value is placed on a totally unserved rural area than on a manually activated system which provides limited services.

Assuming, as an extreme case, that in an underdeveloped country where telecommunications service is not yet highly organized, the captial city has a very modern automatic network. In this case the level of automation will be 100%. One may be willing to qualify this network as more advanced than a network in towns with well organized, manually-activated service where 25% of the telephone sets are located. In this latter country, the degree of automation will be only 75%

However, the manually-activated service must be qualified as superior to one without any service, or with very little service. In addition, the needs of a low level agriculture or livestock farming area may be well-served with a manually-activated network. Again, in the case of a high level agricultural area, a suitable telecommunications network is more necessary for a efficient operation than it is in an industrial working area with close plant because cultivation is strongly influenced by the unpredictable weather, and the amount of precipitation, and because cultivation encompasses a large territory with the cooperation of a number of related industries.

The basic fault of this automation indicator is that it provides information only about the composition of the existing equipment, but does not give guidance as to what percentage of the population will be able to reach the more advanced service.

Main and extension sets

The proportional distribution of the number of the various types of main telephone stations, substations, PABXs (private automatic branch exchanges) as well as the extension sets of public authorities and residences may be used to measure the state of development of a telephone network. Considering that the total number of main telephone stations and substations is composed of essentially different types of sets, it becomes clear that this percentile measure in not useful in practice.

The load carrying capacity of the network not decline if extension sets are installed in residences. Nor will the main lines to PABXs be less overloaded if the number of residential main lines increases. From the point of view of the load capacity, the proportion of the main and extension lines connected to PABX may only be considered as determinant for main and extension sets. The usual proportion is 10% and 90% respectively for main and extension sets. The proportion of the extension sets in developed networks such as Sweden's increases continuously. This phenomena is shown in Table 2. The same tendency may be observed in Spain.

On the other hand, Table 3 shows that this tendency turns in the opposite direction in West German networks.

The data in Tables 2 and 3 show that the proportion of main and extension sets and the change in time of this proportion does not refer to the quality of the provision. This indicator is, therefore, useless.

A new method is needed to evaluate the level of development of the telephone network.

Comparison of the networks of various countries and evaluation of the domestic network of any country requires a method which starts with the analysis of the degree of satisfaction of the telecommunications demands developed on the basis of the industrial production and social structure of the country or region

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Table 2

Proportion of extension sets in Sweden

Year	Density of sets	Percentage main sets	Extension sets
1960	36.81	78.5	21.3
1965	45.96	76.9	23.1
1975	55.64	74.9	25.1
1978	74.40	69.3	30.7

Table 3

Proportion of extension sets in West Germany

Year	Density of sets	Percentage main sets	Extension sets
1960	10.71	54.7	45.3
1965	14.84	56.7	43.3
1970	22.43	63.6	36.4
1978	40.30	71.2	28.8

Continued from page 38

being considered. The level of the telephone networks of countries cannot be evaluated, as in the case of the density telephone sets, in relation to an incomprehensible number varying from 100 sets per 100 inhabitants to 200 per 100 inhabitants according to technical sources; nor in relation to the actual density values observed in the most developed countries. The ratio number of sets connected to the automatic exchange does not refer to the degree of provision within the population, but to the method of switching. Although it is easy to calculate, it is a meaningless number.

Instead of the indicators used up until now, it seems necessary to develop a new method of evaluation which will provide an accurate analysis of the degree of telephone provision. It is possible to develop indicators which are devoid of the defects of the presently used indicators and makes networks comparable on the basis of demand and degree of provision. The proposed first indicator will tentatively be called the *degree of standard saturation* and should be determined for every country. The second indicator will tentatively be called the *degree of accessibility to automation* and would indicate the proportion of the population served by automatic equipment. The indicator of the proportion of main and extension telephone sets should be omitted. The method of computation and application of these two indicators is discussed below.

Degree of standard saturation

Telephone sets connected to the network may be grouped into three categories depending on their role in the production and society, on the load carried by them and on their investment costs: main and extension sets of public authorities, residential sets and public sets.

Main and extension sets of public authorities are considered as prerequisites of efficient production and administration. Therefore, their number should be determined not by the actual level of production, but by the desired level of production.

At a low density, the majority of sets must belong to the public authorities, and these and residential sets approximate the density value of 20 sets per 100 inhabitants.

The number of public authority sets depends on the production structure, the contribution of the various economic branches to the Gross National Product (GNP) and the administrative methods. For public authority sets, the degree of saturation may be computed from the total value of production of all economic branches.

Table 4 shows telecommunication cost ratios which are characteristic to production and economic branches, according to Linda Lee Bowler in her paper "Telecommunication Market Demand and Investment Requirements." Further investigations are needed and such analysis should be extended with data related to the telecommunication demands of the state administration.

The value of the standard saturation related to sets of public authorities is not an absolute value, but a measure that should be determined for each country separately. This measure does not depend on the number of employes in the various economic branches but on their output. In central Europe, in the 1930s the number of agricultural workers was about three times that of today and the value of farm-produce was about one-half the present value. In the 1930s the related telecommunication demands were well satisfied by a few manually-serviced sets. Presently, large-scale farming closely related to industries requires automated service, and VHF (very high frequency) mobile sets, apart from fixed sets.

The density values of public authority sets are higher in countries which are dominated by commerce and tourism than it is in countries which are dominated by agriculture and mining. This generalization takes into consideration the demands of state administrations. It also takes into account the VHF radio telephone sets which have access to the public networks.

Table 4

Telecommunication cost ratio for various branches of economy/production

Branches of economy/production	Cost ratio
Agriculture & forestry	0.0023
Mining & quarrying	0.0010
Construction	0.0034
Manufacturing	0.0040
Transport & communication	0.0104
Energy	0.0027
Wholesale & retail trade	0.0105
Finance insurance real estate	0.0087
Services	0.0147
State enterprises	0.0031

Residential sets

The degree of saturation of residential sets should be determined on the basis of the number of persons living in each household. In addition, it should be considered that some residences require two sets. There also may be a need for sets in some summer residences and mobile sets in some private cars. Saturation may be between 110 and 125 sets per 100 residences. This number does not include extension sets within residences.

The number of persons living in the same household varies between 2.5 and 4.2 in Europe. Lower figures are found in Sweden, Switzerland and Hungary. The maximum is found in Portugal. In Canada there are 3.3 persons per household, and in Australia 3.1 persons form a household. In South America, Asia and Africa, the number of persons living in a household is 6 or more.

Considering this data, the saturation value of 117 sets per 100 residences, which may be taken as average, means a density of 46.8 per 100 inhabitants in areas with 2.5 persons per household. If the number of persons per household is 6 then full provision is at a density of 19.5 per 100 main sets. These two extreme values show that a measure related to the population figure is less suitable to evaluate the degree of provision than a measure related to the number of residences or households.

Public sets

The standard density of public sets may be assumed as 1 set per 100 in-

habitants. Here the population using public domain is to be considered and provisions should be made that within inhabited areas so that anyone can find a free public set within a range of about 100 meters. Depending on the intensity of the traffic on the streets this requirement can be fulfilled by installing one to eight public sets per 2.47 acres. From this number, some sets may be installed on trains and long range buses as radio telephone sets.

Accessibility to automation

It has been shown that misleading conclusions may be drawn from measuring the percentage level of automation. Accessibility to automation, as an indicator provides the proportion of the population of a country that has access to public authority, residential or public telephone sets served by automatic exchange.

In Hungary, for example, the traditionally understood degree of automation is 82.2% despite the fact that only 48% of the population of the country can use automatic services. The value of 82.2% does not describe the real situation and leads to an incorrect conclusion.

The new indicators proposed are more appropriate to describe the level of the network of a country than the measure of density of telephone sets and percentage level of automation were.

The advantage of the presently used indicators is that they can be computed easily from population data and from the global data on telephone networks.

More data and economic and technical forecasting are needed for the proposed new indicators. Also, these proposed indicators do not present basic statistical data but rather, a numerical value that may be used with advantages and reliability in the economical and technical planning.

A difficult task, however, is forecasting the GNP for a given country. The effect of a 50% error in overestimation will result in a acceptable difference for long-term planning. For example, if in a certain country $4000 per capita GNP is actually achieved but, because of exaggerated or optimistic estimation, $6000 per capita GNP is used in the calculation, the density of the public authority sets will be 23 per 100 instead of 19 per 100, which means an excess of 2.0 per 100 in the number of main sets. If the proportion of main and extension sets is 50% to 50%, then the same applies for the extension sets.

If the density for the planned number of households and public sets in the country is raised from the actual value of 55 per 100 to 59 per 100, then the measure of the standard density will include an error of only 7.2% and the value of the density of main sets will have an error of only 4.4%. The error rate of 20% that is still tolerable in long-term planning cannot be reached practically. With the proposed new indicators, the degree of error will be significantly less than when computed with the presently used indicator of density sets, which may include an error up to 50%.

The accessibility of automatic service can be computed from population data and from the number of inhabitants in cities and villages of a given country served by automatic exchanges.

The use of these proposed indicators is possible, reliable and advantageous for those involved in economic and technical planning and forecasting. □

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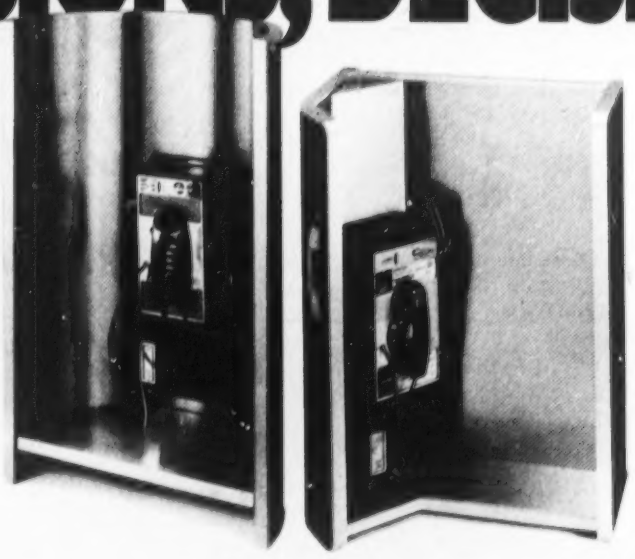

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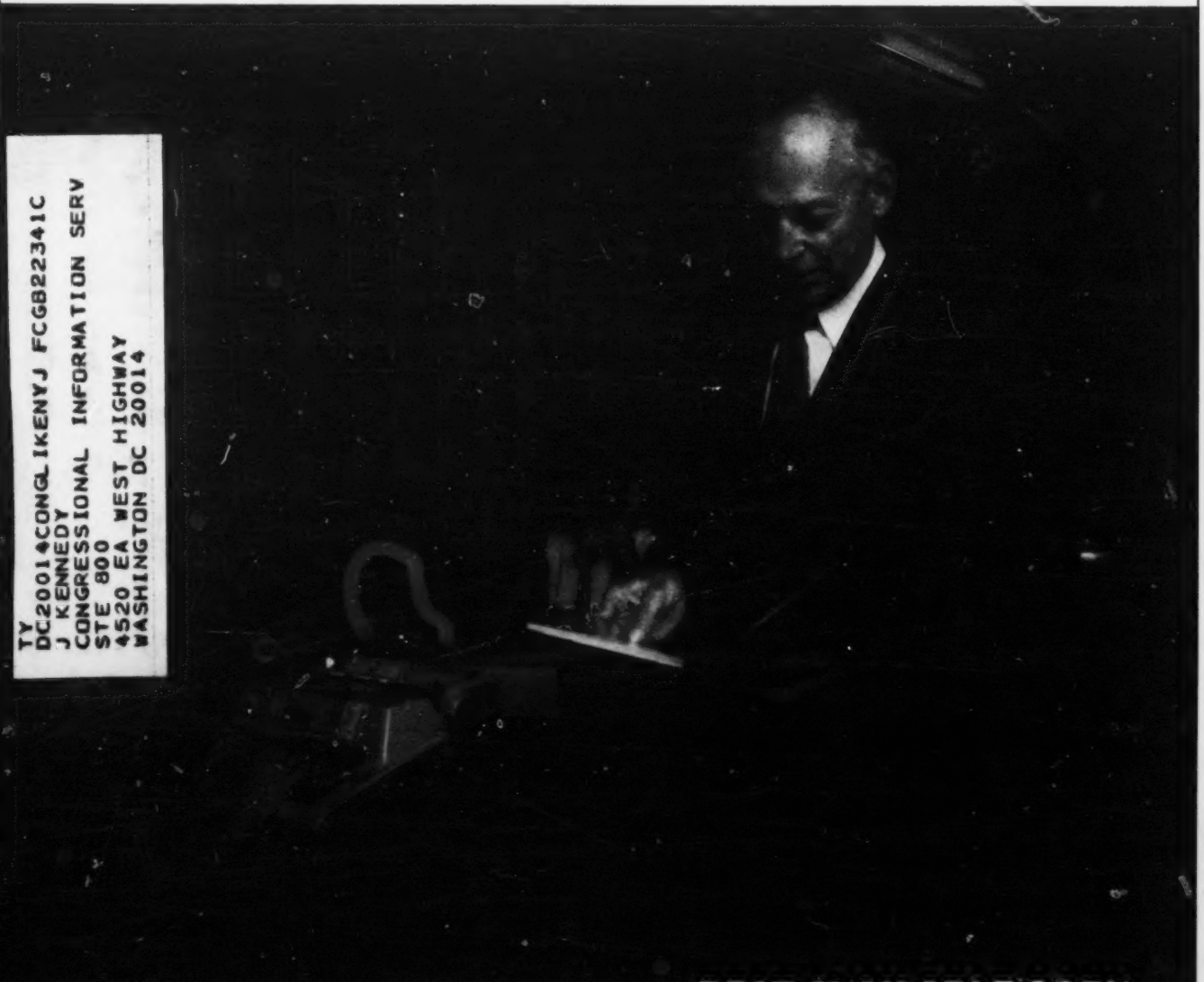

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Cost model plus field trials reduce profit uncertainties of videotex

A quantitative model of costs and revenues provides a framework to analyze the potential profitability and viability of commercial videotex systems

MICHAEL TYLER and HILARY B. THOMAS

THE RAPIDLY INCREASING revenues being devoted to the development of videotex and similar electronic information and transaction services make it urgent to assess their potential for commercial viability and profitability.

Such an analysis can only be conducted with a quantitative model of costs and revenues. The importance of modeling costs and revenues is increased rather than decreased by the various field trials, market trials and start-ups of commercial services. Because most of the cost and revenue characteristics of such trials or services change radically as they progress from the field trial or market trial stage to full-scale operation, trials are not a substitute for quantitative modeling.

Rather, the two activities are complementary. The modeling work helps to identify the key business uncertainties. The trials and service start-ups provide data that can be incorporated in the models to make them more realistic. Throughout, the quantitative modeling process provides a framework for calculating what this data, when obtained, imply for the potential profitability of future full-scale systems or services.

This article outlines the approach Communications Studies and Planning International Inc., New York, has adopted toward assessing expected revenues, costs and profits for a mass market, residential, two-way videotex service in North America. As such, it represents a synthesis of much of the research done for the company's inContext Program, which studied the business viability of residentially-oriented videotex services. The program also examined electronic publishing and transaction services. It models the revenues and costs facing a system operator not involved in the information or service provision ends of the business on any large scale.

Similar methods could be used to analyze other kinds of videotex or related businesses, such as the information provider business, vertically-integrated broadcast or cable teletext services, and business information services.

The analysis is for a mass market, general interest videotex system with information retrieval (electronic publishing), transaction and messaging capabilities. Only revenues from households are considered, although other kinds of systems, such as specialized or business-oriented systems, could be analyzed also.

As of the end of 1981, no commercial videotex system in North America had yet achieved profitability, with the possible exception of Dow Jones' specialized business services for personal computer users. There are large start-up costs and scale-up problems involved, so this is not surprising. It is to be expected that losses will be reported in the early years. Whether and how a videotex system makes a profit is a vital question; but it is one that cannot be answered except with a mathematical model that, by extrapolation from the available cost and revenue data, seeks to show

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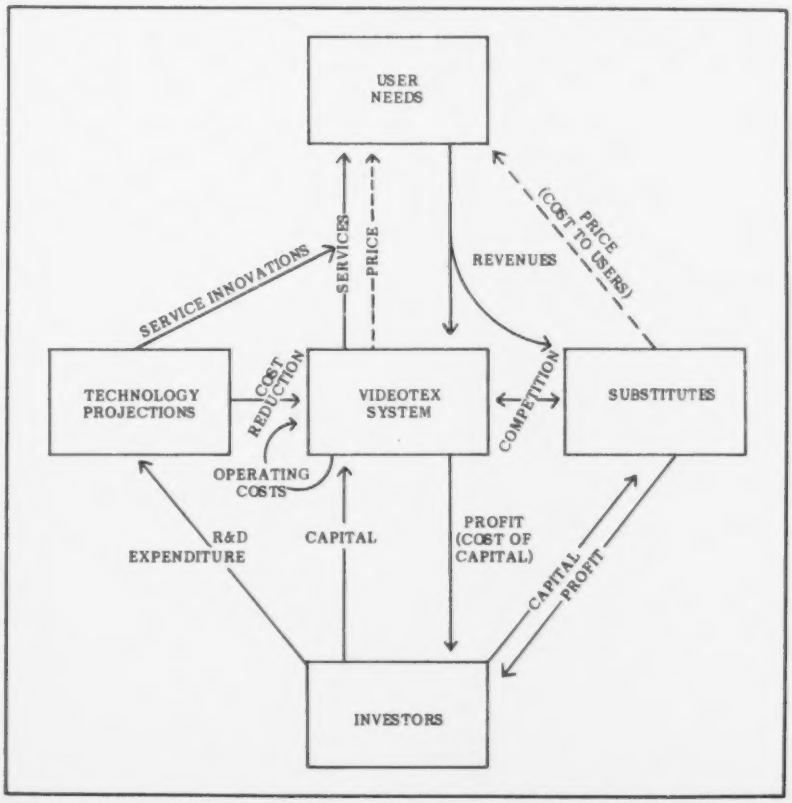

FIG. 1 *Schematic diagram of factors which affect the profitability of a videotex operation.*

Michael Tyler is President, and *Hilary B. Thomas* is Director of Communications Studies and Planning International Inc., New York. This report will be presented at Viewdata '82, Oct. 12-14, in London.

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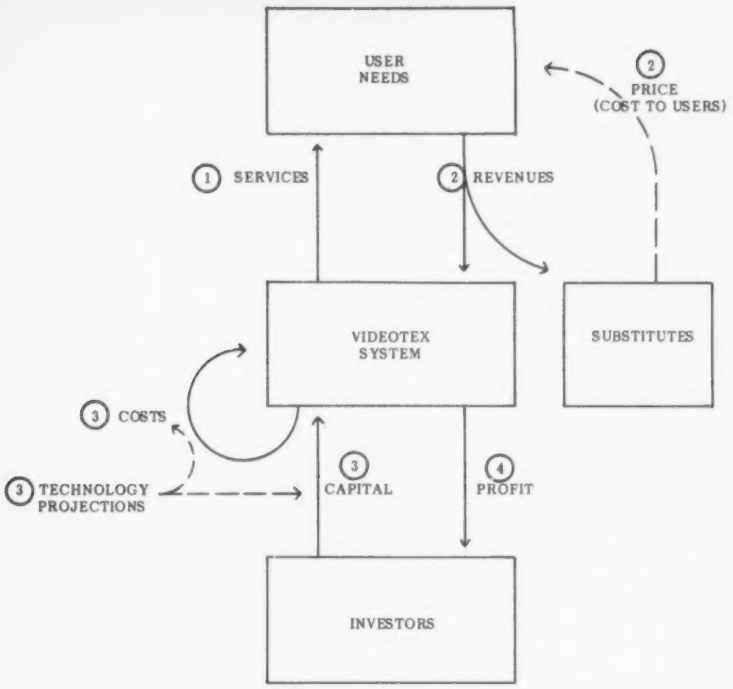
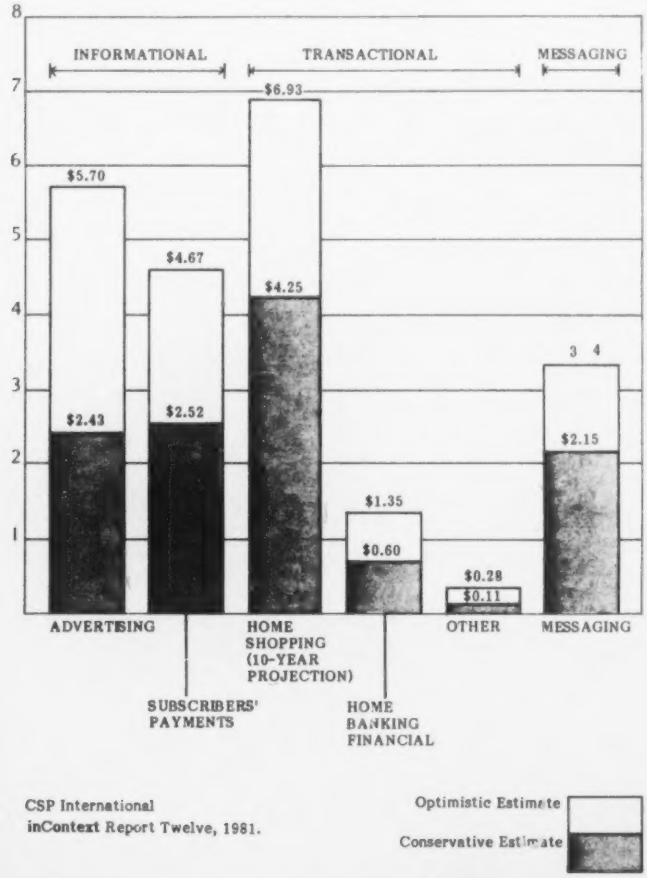


FIG. 2 *(above) Outline of the analytical approach.* **FIG. 3** *(below) Components of estimated potential revenue for an average household per month.*



Source: CSP International inContext Report Twelve, 1981.

whether a full-scale videotex system could be efficiently profitable once scaled-up to show an acceptable return on investment (ROI) over its total life.

The unfamiliarity of videotex and similar services to users and the way costs and revenues per subscriber change dramatically as the scale of operations increases imply that there will be a period of several years before profit potential can be fully tested in the marketplace.

For example, it is not possible to realize full revenue potential until a complete range of high-quality data bases and transaction services can be provided. Information and service providers are not likely to invest in service offerings until there are a substantial numbers of users and revenue potential has been demonstrated.

Similarly, the true costs of building and operating a videotex system will not be apparent until the traffic-handling capacity and quality of service provided by full-scale configurations of the computer communications system are measured in practice and considerable experience has been accumulated. Field trial or market trial systems with a few hundred users consequently can yield only partial evidence on commercial viability, even when they are well-designed.

The discipline of business modeling focuses attention on the specific information needs that a trial and the associated data collection and evaluation processes should meet. The modeling work provides a systematic framework to interpret the separate items of cost, usage and revenue data that a trial generates, and thus reduces key business uncertainties.

The interactions between the variables that influence the profitability of an operational videotex system are very complex. They are illustrated at a broad conceptual level in Figure 1. The problem facing the practical analyst at the present early state of videotex development is finding a simple representation which captures the main interactions well enough to provide an approximate but broadly reliable indication of whether videotex systems can be profitable.

The stages of analysis are shown in Figure 2. In the first stage, we reviewed the present characteristics in broad terms, including cost trends, of various businesses where videotex may offer a quicker, cheaper, more

Continued on page 72

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capable and even more pleasant way for households to transact particular types of business. We also surveyed various precursor activities—activities which are already performing some of the functions that we expect will be performed by videotex systems—for an early indication of the role which videotex can be expected to play.

The next step, or the second stage, was to develop a detailed revenue analysis for each of the areas of business where, on the basis of preliminary work, videotex appeared to provide an attractive alternative to conventional non-electronic methods of operation for at least some functions or some types of users. The analysis depended on the quantification of economic activities in the areas where videotex services have been defined, and on an assessment of the likely share of this activity which a developed videotex service might capture.

The cost of setting up and operating a videotex system for the mass market home user was analyzed in the third stage. This analysis depended in part on a projection of technology and in part on an analysis of operating requirements.

Finally, the profitability of videotex operation, the fourth stage, was assessed on the basis of the cost and revenue estimates previously developed.

Indicators of potential demand

The most promising areas of videotex demand are those in which conventional methods of providing a service show rising costs, in which demand is buoyant and which are suited to the videotex method of delivery.

Two kinds of analyses are helpful in approaching the problem of assessing the commercial viability of videotex:

- Trends of economic performance favoring the long-term prospects of videotex; and
- Developments in services and technologies related to videotex which might be considered precursors to videotex services.

Economic trends favor the long-term prospects for videotex development. One factor is the long-standing trend of replacing labor with capital. The maintenance and improvement of the standard of living in Western economies has depended on continuous investment of capital resources to increase productivity. This has been most noticeable in many manufacturing industries.

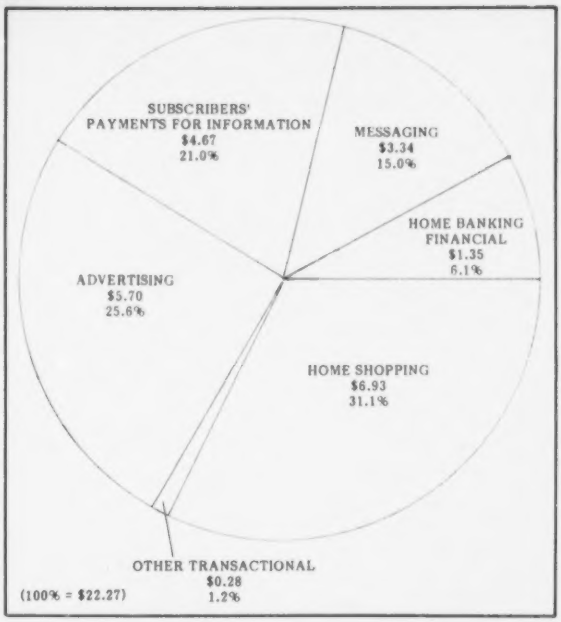

FIG. 4 *Composition of estimated per-household revenue on optimistic estimates of revenues (%).*

By comparison, the capital investment allocated to enhance the productivity of information processing has lagged significantly behind levels in industrial occupations. Videotex offers opportunities to facilitate three currently labor-intensive activities: transaction processing, message handling and information retrieval.

Transaction processing, including billing and bill payment, banking and direct selling to the home, represents a very large area of business. Although some technological developments, such as optical character recognition (OCR), have improved its efficiency, transaction processing remains labor-intensive and expensive. Videotex transactions, which are entered by the customer in electronic form, can provide an important area for service development with high productivity and low unit costs.

The physical transmission of messages, a fundamentally labor-intensive process, has become increasingly expensive in real terms. Thus, mass electronic dissemination of messages through a medium such as videotex is likely to become increasingly attractive.

Although perhaps less important from a productivity standpoint than transaction processing and message handling, information retrieval and publishing are also labor-intensive activities. The comparative advantage of electronic media for these activities is increasing rapidly.

Initial evidence of the viability of videotex systems can be gained from precursors of various applications of videotex. Precursors to fully-developed videotex transaction processing can be found in financial services, shop-at-home services and mail order retailing, all of which are being tested in North American markets.

In financial services three significant developments are the introduction of bill paying by telephone, the rapid expansion in the provision and use of automatic teller machines (ATMs), and the introduction of the debit card.

As conceived, videotex home banking services usually will permit two kinds of functions. One is an information and accounts-management system through which customers can make balance inquiries, transfer funds between accounts, and conduct other banking activities. The other is a bill paying system.

ATMs and bank-by-phone systems each represent precursors of one of the pieces of the potential videotex service package. Many ATMs, for example, permit balance inquiries and transfers between accounts. Bank-by-phone services are analogs of a videotex bill paying system; the eventual replacement of a human operator makes the economics of a videotex system more attractive to banks.

The existence of ATMs is important for several additional reasons. Their use will make consumers accustomed to performing bank transactions by machines. Moreover, th

Continued on page 7

ATMs eventually will permit banks to reduce their conventional branch networks by using a combined ATM/videotex system to provide a full range of banking services.

The increasing acceptance of ATMs over the last 5 years substantiates this trend. In 1977, the average number of transactions per machine was 1500 per month. By 1981, the monthly usage had grown to 5000 transactions per month per ATM.

Increased acceptance of a debit card as a substitute for cash could provide an even greater impetus for developing bank-at-home services. Freed from a dependence on cash, banks and customers will be able to conduct a growing proportion of transactions electronically, providing even greater advantages to a videotex service.

Shop-at-home services provide a second major area of transaction revenue. Rising real estate, building, energy and capital costs have increased the costs of conventional retail operations and spawned competing service concepts. Warehouse supermarkets, providing a limited range of goods which are displayed simply at low cost, have captured a significant share of the retail food market since their emergence in the early '70s. These may represent precursors to the electronic supermarket in which orders are entered from a shop-at-home videotex list and filled using modern, labor-saving inventory management systems and an efficiently organized delivery system.

Although speculative at this time, such a concept attacks more of the critical cost areas in retailing than does the warehouse concept alone.

The increasing share of mail-order services in the retail market is another favorable indication for the viability of videotex. The volume of mail-order business has increased massively, from an estimated $12 billion in 1975 to $26.2 billion in 1978. This development in retailing is a reflection of continuing economic and social trends such as the increased participation of women in the labor force, increased shopping activity by males, fewer full-time homemakers and, associated with all this, increasing dissatisfaction with time-consuming traditional shopping.

A number of cable systems already have organized shop-at-home services featuring video demonstrations of products, combined with telephone ordering. Such services would complement a videotex shop-at-home service and permit more efficient order entry. A videotex catalog, promoted on a cable video channel, also could be a powerful marketing device and would facilitate impulse purchasing.

Table 1

	Cabletext	Telephone-based system
IRR* with optimistic revenue projection	34%	47%
IRR with conservative revenue projection	7%	10%

* Real internal rate of return based on inflation-free projections of costs and revenues

Six different videotex revenue sources are considered in this research: direct expenditures by subscribers, primarily on information services; advertising; fees from financial transaction services; fees from retail (shop-at-home) transactions; messaging; and miscellaneous supplier-financed services, such as on-line information and reservation systems.

The estimates of average per-household revenues are summarized in Figures 3 and 4. The revenue estimates were derived from the data on the total size of each relevant area of economic activity, together with a detailed analysis of substitutability between videotex and existing information and communication media. This method of deriving the revenue estimates is conservative, in that a new communication medium with exceptionally attractive qualities can generate additional revenues as well as divert them from other communications media.

However, these revenues must come from somewhere. When the revenues come from households, they must be diverted from somewhere in the household's existing budget. Analyses carried out in the United States, Canada and the U.K. show that the proportion of household budgets spent on information and communication goods and services has remained stable over time. Consequently, it would not be prudent to base a videotex business plan on the expectation of any major reallocation of the household budget. It is more realistic to assume that households' expenditures on videotex will be diverted from other information-related goods and services. Similarly, other sources of revenue for videotex can be analyzed by estimating the likely diversion of funds from existing non-electronic businesses. The overall revenue estimates for videotex are built from a series of such studies of different revenue sources.

The next stage of the analysis involved building a model of a videotex system operator's costs, and combining it with the revenue estimates to yield overall indicators of the return on investment. This is done for two cases. The first was a residential cabletext system including two-way videotex capability, in which the system operator supplies the user terminals, built into the cable converter. The second was a telephone-based videotex system in which the system operator does not pay for the terminals. The terminals are assumed to be videotex terminals, videotex adapters, videotex-equipped television sets or personal computers owned or rented by households.

The analysis results are shown in Table 1 for two sets of variant revenue assumptions: one optimistic and the other conservative. The optimistic revenue estimates imply very high rates of return but are clearly at the upper boundary of possible outcomes. While the conservative projection is probably closer to the most likely outcome, it is probably too low. The structural assumptions and numerical parameters involved in deriving these results are explained in the text of the report.

Profitable operation of videotex systems is well within the range of practical possibility: real rates of return (as measured by the internal rate of return calculated by standard discounted cash flow methods) in the range of 10% to 20% (corresponding to an accounting rate of return of 20% to 30% if inflation runs at 10%) appear attainable. Even allowing for the high degree of risk involved because the cost and revenue estimates are untested in practice and there are heavy negative cash flows in the early years, it is likely that this would be acceptable to many potential corporate investors, given their known minimum acceptable rate of return.

The range between the best and the worst result does, however, highlight the continuing uncertainties that can be reduced only by the combination of operational experience and further detailed analysis.□